Research Institute Leiden Observatory

(Onderzoekinstituut Sterrewacht Leiden)

Annual Report 2007

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A Dutch stamp celebrates the bicentenary of the birth of the Leiden astronomer Frederik Kaiser. Kaiser holds a special place in the history of Dutch astronomy. Lacking an academic background and personal wealth he nevertheless single-handedly managed to raise moribund Dutch astronomy to an international level. Educated by his German-born uncle, a proficient amateur astronomer, Kaiser soon proved himself an exceptional talent. Starting his career as an observer in Leiden, he eventually held the Leiden chair of astronomy. In the latter capacity he successfully lobbied for an up-to-date, fully equipped observatory, the first of its kind in the Netherlands. By introducing statistics and precision measurement in Dutch astronomical practice, he ensured that Leiden observations rivaled with the best in the world. Under his directorship Leiden became an important node in the international astronomical network. A prolific author, he wrote several best selling books on popular astronomy in order to secure social support for Dutch astronomy. If astronomy is now a flourishing field in the Netherlands, we owe this partly to his ceaseless efforts.
(Frans van Lunteren)

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Production Annual Report 2007:
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Sterrewacht Leiden

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Chapter 1

Dear Reader,

In this booklet we have collected the main events and achievements of De Leidse Sterrewacht over 2007. It was a year that saw some important changes, happy and sad farewells, and a continued thriving scientific activity.

Let me start with the good-byes.

Our scientific director, Tim de Zeeuw, was selected as the new Director General of the European Southern Observatory (ESO), succeeding Catherine Cesarsky. This makes him the fourth Dutch DG of the seven incumbents thus far, after Adriaan Blaauw, Lo Woltjer and Harry van der Laan (all past Leiden faculty!). Tim was director of the Sterrewacht since 2003, and NOVA director since 1993. He took up his new post in München on September 1.

Rudolf Le Poole formally retired in November, and his work was honoured in a special one-day symposium that saw many old and new friends come to Leiden. Organizing the event was a bit of a challenge:

Rudolf has been active in so many different fields, from interferometry to active optics, from astrometry to sailing, that it was hard to cover everything adequately! But it was a nice day, and the following week Rudolf was back at work as usual albeit in a slightly smaller office.

Harry van der Laan completed his term as member and chair of our Supervisory Board (Raad van Toezicht) in the summer, marking 40 years of association with the Sterrewacht. The Sterrewacht will miss his valuable support, knowledge and experience, but I hope we can still count on him for informal help as well as the occasional after-dinner speech. Johan Bleeker took over as the new chairman of the Raad, and Christopher Waelkens (Leuven) agreed to join as a new member.

Also in the university there were important changes, with the retirements of our Dean Frans Saris and Rector Magnificus Douwe Breimer. Both have been very supportive over the years, and in recognition of this fact we persuaded the IAU to name minor planets 10980 and 10981 after them. Long may they watch over us!

Sadly, in November we lost a long-time friend of the Sterrewacht in Coen Oort. As son of Jan Oort he grew up in the Sterrewacht on the Kaiserstraat, and even though his career took him to the world of government, business and finance, he was an invaluable supporter and helped greatly in setting up and managing the Oort and Leids Kerkhoven-Bosscha Funds. He served on the Raad van Toezicht from 1999 til 2006. Our warmest thoughts go out to the Oort family. We are very grateful that Fokko van Duyne agreed to succeed Coen.

In January 2008 we were saddened to learn that Fjeda Walraven had died in South Africa, his adopted home land. Next year's Annual Report will contain an in memoriam for him. A month later the sad news reached us that Dini Ondei, the fondly remembered secretary to Jan Oort at the Sterrewacht from the 1960s to the 1980s, had passed away.

The Sterrewacht welcomed a great number of visitors during the year. These included the 2007 Oort Professor, Scott Tremaine (Princeton) as well as many participants in a workshop he helped to organize at the Lorentz Center, on near-Keplerian dynamics. Prof. Tremaine also delivered the annual public Oort lecture on "New worlds, in search of planets outside our solar system". The year's Sackler lecture on "Bringing our Galaxy's supermassive black hole and its environs into focus with laser guide star adaptive optics" was given by Prof. Andrea Ghez from UCLA. Numerous workshops took place at the Sterrewacht and in the Lorentz Centre.

Being an astronomer is a privilege, and it implies that we disseminate our discoveries and our work to as broad an audience as possible. A number of special outreach events took place, including a symposium for Bruno Ernst (among many other achievements founder of the public observatory 'Volkssterrewacht Simon Stevin') and an 'astronomy olympiad' for high school students. The Universe Awareness project, run from the Sterrewacht, promotes knowledge of astronomy among underprivileged children world-wide. The old Observatory building plays an important role in our outreach activities: it is used regularly for lectures, tours and sky viewing as well as for the annual exhibition on the national science day. The building is not in the best shape, and we took part in a TV competition (ultimately unsuccessful, alas) to win a million euro grant for restauration of the roof and telescopes domes. Fortunately as of this writing (May 2008) the minister of education, culture and science has set aside a large grant for the restauration of the building.

Scientific research and teaching are of course the main activities at the Sterrewacht, and most of this report is concerned with those. In 2007 our 18 faculty, 30 postdocs and 45 graduate students together produced some 300 publications including 171 refereed articles, 95 articles in conference proceedings, 8 PhD theses, a book, and 14 astronomical catalogues. The 8 PhDs awarded during the year were on topics as diverse as oscillations of stars, interstellar chemistry (alcohol!), and the formation of massive galaxies in the early universe. Involving BSc and MSc students in research is one of the key principles of our teaching. Sometimes this leads to spectacular results, as when three BSc students discovered a candidate exoplanet as part

of their research project! The discovery resulted in much press coverage, including a TV appearance on a daily talk show (at which supervisor Ignas Snellen was asked to explain why his students only scored an 8.5...).

The year ended with two pieces of good news: Mariska Kriek was awarded the Kok prize for the best PhD thesis of the year in the Faculty, and 2009 was designated the International Year of Astronomy by UNESCO. A fitting end to a succesful year!

The achievements described above and in this volume are only possible through the brilliance, dedication and hard work of the faculty, support and temporary staff of the Sterrewacht. Together we have the privilege to continue the great tradition of this Institute. One of the most important figures in this tradition will be marked in 2008 as we celebrate 200 years since the birth of Frederik Kaiser. He was director of the Sterrewacht from 1837 until his death in 1872 and engineered the construction of the Sterrewacht building in the Hortus Botanicus. To commemorate the event a special postage stamp was issued, which is reproduced on the cover of this Annual Report.

I hope you enjoy reading this Annual Report.

Koen Kuijken
Scientific Director
Sterrewacht Leiden

Chapter 2

Research

Sterrewacht Leiden

Chapter 2

Research

The research activities at Leiden Observatory span a very wide range, from small bodies in the Solar System to reionisation of the Universe and cosmology on the largest scales. This section aims to provide an overview of active areas of research, and a summary of the principal results obtained in 2007. To get a sense of the sheer volume of work produced by Observatory researchers, the reader is recommended to Appendix X, which gives a complete list of material published in 2007.

2.1. Solar System

2.1.1. Minor Planets

Many new asteroids were identified, numbered, or named by I. van Houten-Groeneveld, continuing the work by herself and her late husband, C.J. van Houten. Definitive numbers were given to 170 of these objects by the Minor Planet Center (Cambridge, USA) in 2007. 50 names were given to minor planets discovered by the Van Houtens in 2007. Of particular interest are: (10980) Breimer, (10981) Fransaris, (11431) Karelbosscha, (11432) Kerkhoven and (12150) De Ruyter, which have been named after Belgian or Dutch famous people.

2.2. Exoplanets

2.2.1. Transisting Planets

Snellen and collaborators continued their work on the detection and characterisation of transiting extrasolar planets. Most of the more than 200 known extrasolar planets have been found using the radial velocity technique. Although their orbits are well known, not much is being learned about the planets themselves. This is very different when the orientation of a planet is such that it transits its host star, regularly blocking off a fraction of the star light. For these planets, the mass, radius, and average density can be determined, and their atmospheres probed through secondary eclipse photometry and transmission spectroscopy. Highlights of the research by Snellen and collaborators in 2007 are the discovery of a possible new transiting exoplanet, and very accurate observations of a transit and secondary eclipse of the transiting exoplanet OGLE-TR-113 in K-band.

2.2.2 Exoplanet GL 86

Together with Lopez at Nice Jaffe obtained MIDI/AMBER data on the exoplanet GL86. If successful this will represent the first detection of exoplanets in their own emitted light.

2.3 Protostars and Circumstellar Disks

2.3.1. Ice survey of low-mass protostellar envelopes

Boogert (NOAO), Pontoppidan (Caltech), van Dishoeck, Lahuis and the c2d-IRS team finished their Spitzer + ground-based 3-38 μm spectral survey of a sample of 41 low luminosity young stellar objects (YSOs) down to proto-brown dwarfs; previous mid-infrared spectra had been limited to high-mass protostars. An important first conclusion is that all features observed toward massive YSOs are also seen toward low mass YSOs, indicating that processing of the ices by internal UV fields is a minor factor in the early chemical evolution of ices. The long-known 6.0 and 6.85 μm bands are detected toward all sources, with the most deeply embedded Class 0 YSOs showing the deepest bands ever observed. In almost all sources the 6.0 μm band is deeper than expected from the bending mode of pure solid H_2O at 10 K alone. The depth and shape variations of the remaining 5-7 μm absorption indicate that it consists of 5 independent components, which, by comparison to laboratory studies from Leiden, must be from at least 8 different carriers. Simple species such as HCOOH, H_2O, $HCOO^-$, CH_3OH and NH_3 are responsible for much of the absorption.

The solid CO_2 15.2 μm bending mode, studied by Pontoppidan, Boogert, van Dishoeck, Öberg and the c2d-IRS team for the same low-mass YSO sample, indicates a CO_2/H_2O ice abundance ratio of 0.32 +/- 0.02, significantly higher than that found in quiescent clouds and massive YSOs. Decomposition of all the observed CO_2 profiles requires a minimum of five unique components. Roughly 2/3 of the CO_2 ice is found in a water-rich environment, while most of the remaining 1/3 is found in a CO-rich environment, from comparison with Leiden laboratory data. Combined with ground-based CO data, a model for CO_2 ice formation is proposed in which low-density clouds form the CO_2:H_2O component and higher density regions the CO_2:CO ice during and after the freeze-out of gas-phase CO when the cloud collapses to form the star. Subsequent distillation of the CO_2:CO component through CO evaporation at ~20-30 K and formation of pure CO_2 via segregation from the H_2O rich mantle at higher levels of heating (>50 K) may explain the observed band splitting. Thus, as for high-mass YSOs, the solid CO_2 15.2 μm profile is an excellent diagnostic of thermal processing.

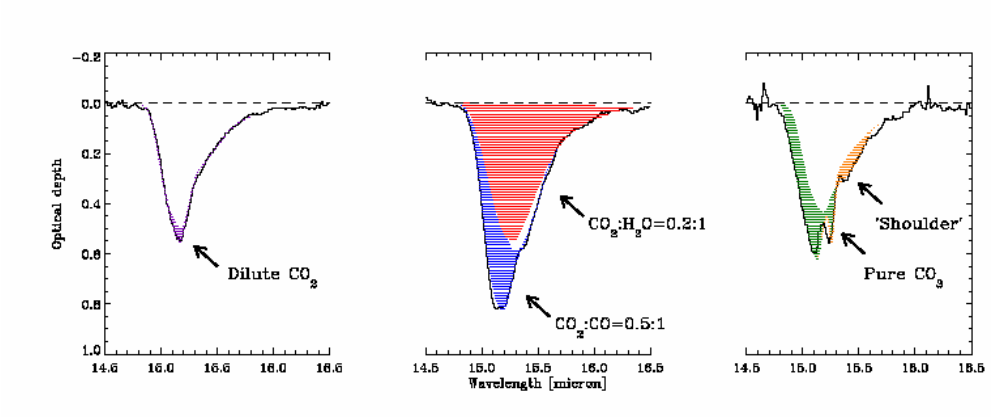

Figure 1: Illustration of the five different components of the solid CO2 band. The Spitzer spectra of Oph IRS 51 (left), Serpens SVS 4-5 (middle) and Oph RNO 91 (right) are shown. The identifications are based on laboratory spectra taken in the Raymond & Beverly Sackler laboratory (from: Pontoppidan et al.).

2.3.2. How much X-ray and UV radiation do protostars emit?

Stäuber, Benz (both ETH Zürich), Jørgensen (CfA), van Dishoeck and co-workers published their JCMT survey of ions and radical toward low- and high-mass protostars, with the aim to probe any high energy radiation emitted by these sources which is not directly observable owing to their large extinctions. The species are selected to be particularly sensitive to either X-rays or UV radiation based on chemical models by Stäuber et al. For high-mass sources, the CN, SO^+ and CO^+ abundances are best explained by an enhanced UV field impacting gas at temperatures of a few hundred K. For low-mass YSOs, an X-ray enhanced region close to the protostar (<500 AU) is more plausible. The observed abundances imply X-ray fluxes for the deeply embedded Class 0 objects of $L_X \sim 10^{29}$-10^{31} erg s^{-1}, comparable to those observed from less deeply embedded YSOs.

2.3.3. PAHs in disks around young stars: spatial distribution and sizes

Geers, van Dishoeck, Visser, Augereau (Grenoble) and co-workers used VLT-VISIR, VLT-ISAAC and VLT-NACO spectra of 29 disks around T Tauri and Herbig Ae stars to determine the presence and location of the emission from polycyclic aromatic hydrocarbons (PAHs). Spatial-extent profiles of the 3.3, 8.6, 11.2, and 12.6 μm PAH features and the continuum emission have been derived. For 6 sources, the PAH spatial extent is confined to scales typically smaller than 0.12-0.34'', corresponding to radii of 12-60 AU, definitively associating the PAHs with the disks. For HD 100546, the 3.3 μm emission is confined to 12 ± 3 AU, most likely associated with the outer rim of the gap in this disk. Gaps with radii out to 10-30 AU may also affect the observed PAH distribution for other sources.

The PAH chemistry and emission from protoplanetary disks has been modelled by Visser, Geers, Dullemond (MPIA Heidelberg), van Dishoeck and coworkers. PAHs can exist in different charge states and they can bear different numbers of hydrogen atoms, with the equilibrium (steady-state) distribution depending on the size and shape of the PAHs and on the physical properties of the star and surrounding disk. Destruction of PAHs by UV photons, possibly in multi-photon absorption events, is taken explicitly into account. The chemistry model is coupled to a radiative transfer code to provide the PAH emission together with the spectral energy distribution (SED) from the star+disk system. It is found that normally hydrogenated PAHs account for most of the observed PAH emission, with neutral and positively ionized species contributing in roughly equal amounts for Herbig Ae stars. PAHs of 50 carbon atoms are destroyed out to 100 AU in the disk's surface layer, and the resulting spatial extent of the emission does not agree well with the observations of the 8.6 and 11.2 μm spatial extent measured by Geers et al. Rather, large PAHs of about 100 carbon atoms or more are needed. The PAH emission from T Tauri disks is much weaker and concentrated more towards the central star. Positively ionized PAHs are largely absent because of the weaker radiation field.

2.3.4. Silicates in disks: where does the crystallization and grain growth occur?

Merín, van Dishoeck, Augereau (Grenoble) and the c2d-IRS team discovered as part of the "Cores to Disks" Spitzer Legacy program a very low mass star close to the brown dwarf boundary in Lupus III, SST-Lup3-1, with a circum(sub)stellar disk. It is the first of young brown dwarf with a full 5-35 μm spectrum, showing strong and prominent amorphous and crystalline silicate features out to 33 μm. The dust in the disk upper layer has a crystalline silicate grain fraction between 15% and 33%, depending on the assumed dust continuum. The hot (~300 K) dust responsible for the 10 μm feature consists of a roughly equal mix of small (~0.1 μm) and large (~1.5 μm) grains, whereas the cold (~70 K) dust responsible for the longer wavelength silicate features contains primarily large grains (>1 μm). Since the cold dust emission arises from deeper layers in the inner (<3 AU) disk as well as from the surface layers of the outer (3-5 AU) disk, this provides direct evidence for combined grain growth and settling in the disk. Since only the inner 0.02 AU of the disk is warm enough to anneal the amorphous silicates, even the lowest fraction of 15% of crystalline material requires either very efficient mixing or other crystallization mechanisms.

Pontoppidan, Blake (both Caltech), Stapelfeldt (JPL), Dullemond (Heidelberg) and van Dishoeck used Spitzer IRS spectroscopy and 2D radiative transfer modeling of the edge-on disk the "Flying Saucer" in Ophiuchus to study the grain size distribution. Its SED exhibits the characteristic two-peak shape predicted for a disk viewed very close to edge-on. The short-wavelength peak is entirely due to photons scattered off the surface of the disk, while the long-wavelength peak beyond 15 μm is due to thermal emission from the disk itsel. The depth and the wavelength of the mid-infrared SED "valley" constrain the large grains in the disk to have sizes of 5-10 μm at radii of 50-300 AU. The detection of relatively large grains in the upper layers implies that vertical mixing is effective, since grain growth models predict that such large grains would otherwise settle deep in the disk on short timescales.

Kessler-Silacci (Texas), Dullemond (Heidelberg), Geers, van Dishoeck and co-workers analyzed the c2d-IRS and Spitzer results which indicate that the grain size and crystallinity may be correlated with the spectral type of the central star and/or disk geometry. Using a simple two-layer disk model

it is found that the radius of the 10 μm silicate emission zone goes as $(L^*/Lsolar)^{0.56}$. The observed correlations, together with simulated spectra of olivine and pyroxene mixtures, imply a dependence of grain size on luminosity. Combined with the fact that the emission radius is smaller for less luminous stars, this implies that the apparent grain size of the emitting dust is larger for low-luminosity sources. In contrast, the models suggest that the crystallinity is only marginally affected, because for increasing luminosity, the zone for thermal annealing (assumed to be at T>800 K) is enlarged by roughly the same factor as the silicate emission zone. The observed crystallinity is affected by disk geometry, however, with increased crystallinity in flat disks. The apparent crystallinity may also increase with grain growth due to an increase in contrast between crystalline and amorphous bands.

2.3.5. Chemistry in Evolving Protoplanetary Disks

Hogerheijde studies the formation of stars and their planetary systems. He focuses on observations at millimeter and infrared wavelengths, which probe the cold gas and dust in star-forming regions and which can penetrate the dense material surrounding young stars. Much of his research is centered on the structure and composition of protoplanetary disks, but he also studies the earlier phases such as prestellar cores and embedded young stars, as well as 'late' phases represented by comets as left-overs from the early Solar System. In this work he uses molecules and dust to measure density, temperature, mass, and velocities, and employs detailed radiative transfer methods to quantitatively interpret the observations. Throughout this the chemical evolution is used to track the evolution of the objects, which is possible because of the similarity of the dynamical and chemical time scales involved. In this research, Hogerheijde works with postdoc Crapsi, and graduate students Brinch, Panic, and Salter, as well as several master's students (Martinez, van Weeren, Schouten, and Kockx).

In one of the research highlights of 2007, Brinch, Hogerheijde, Crapsi, and Hill conducted comprehensive study of the Young Stellar Object L1489 IRS. This study focused on the complex velocity field and unusual geometry of this source: although L1489 IRS looks like a run-of-the-mill embedded object, its resolved millimeter-interferometric image is more reminiscent of a disk with an unusually large radius of 2000 AU. At the same time, its velocity

field seems dominated by rotation, but significant radial motions are also present. To elucidate this object's structure, Brinch et al. used a wide range of observations, from the near-infrared to the sub-millimeter regime, including newly obtained sub-millimeter interferometry data from the Submillimeter Array (SMA) in Hawaii. The combination of infra-red photometry and spectroscopy on the one hand, and sub-millimeter measurements of molecular lines on the other provided good allowed Brinch et al. to uncover the structure of L1489 IRS on scales between a few tens of AU out to to several thousands of AUs: L1489 IRS is surrounded by a protoplanetary disk in Keplerian rotation deeply embedded inside a relatively large, flattened envelope. In this envelope, material spirals in toward the inner disk. Interestingly, the rotation axes of the disk and envelope are misaligned by tens of degrees, suggesting that the angular momentum axis of accreting material is not constant over time. Furthermore, the star deep inside L1489 IRS is likely to be a very close binary, which explains the large rotational velocities and low luminosity of the object.

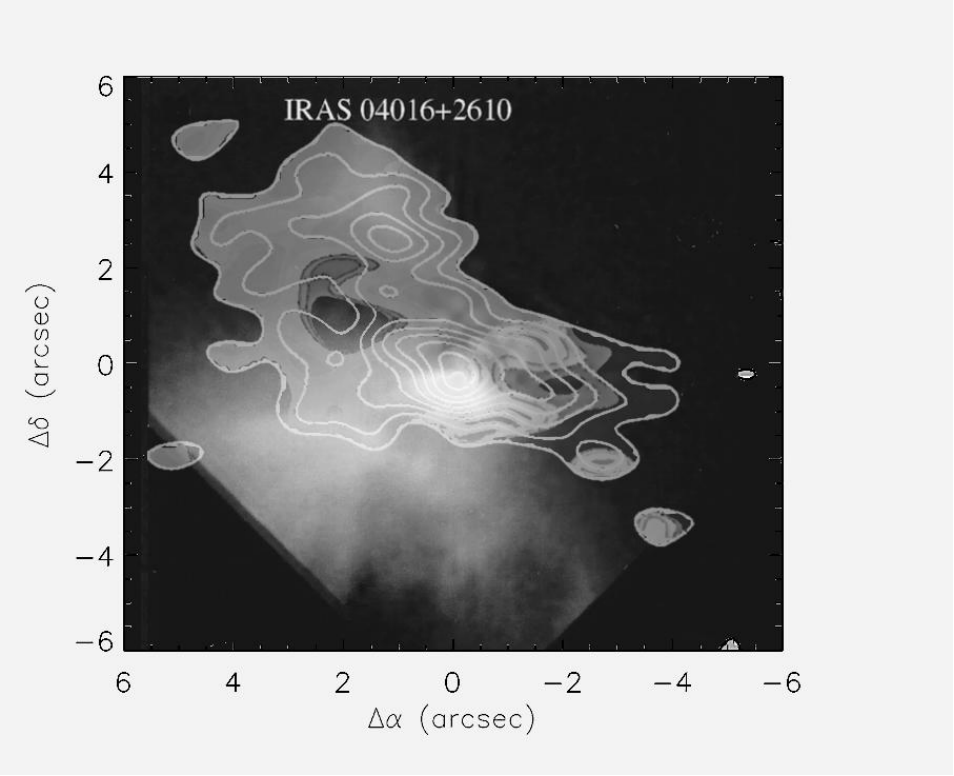

Figure 2: Composite image of the HCO+ 3-2 line emission detected with the Submillimeter Array (SMA) and the near-infrared scattered light obtained with the Hubble Space Telescope, toward L1489 IRS. The SMA line data, shown in contour lines, reveal the rotation in the inner envelope and disk (coded as black/white shading), and are closely anti-correlated with the scattered light, shown in the hazy grey-scale. This corresponds to the near-infrared photons scattering off the dense structures probed by the HCO+ line data, and illustrates the power of high-angular resolution observations at different wavelengths. From Brinch et al. (2007).

2.4 Star Formation

2.4.1. Massive Star Formation

Van Langevelde, Hill and Torstensson continued their research into high mass star formation regions. Their work focused on the youngest massive stars, and the molecular environments in which they form. Young massive stars form deeply embedded in their natal molecular cloud, where they are optically obscured prior to main sequence evolution. They form in clustered environments on more rapid timescales and at further distances than their lower mass counterparts. Consequently it is difficult to pinpoint the individual stages of the evolution of a massive star. Young massive stars are often associated with radio continuum emission, infrared emission; maser emission (in particular the methanol variant) as well as (sub)millimetre continuum emission. The work of these authors focused on a sample of star formation regions, derived from methanol maser associations.

Hill continued her work on a millimetre continuum sample derived initially from radio continuum and methanol maser selected sources. This program included analysing the spectral energy distribution measurements of the sample. The results indicate the occurrence of millimetre continuum sources that are possibly associated with the earliest stages of massive star formation prior to the onset of methanol maser emission. However, it is not yet clear which of these millimetre continuum sources will form stars, although most of them contain enough mass to support the formation of stars in excess of 10 solar masses.

In order to ascertain which of the millimetre continuum sources are forming stars, Hill undertook a large-scale spectral line study of these millimetre sources. To date, a sample of 80 of these millimetre sources have been observed in 13 spectral line species, with more lines planned for the future. These data show that the millimetre sources display rich, complex chemistries, not unlike sources with a methanol maser association. These spectral line species allow us to determine and examine source specific parameters such as line width, temperature, virial mass and density, which will allow us to obtain a handle of the physical parameters.

Van Langevelde and Torstensson continued their work on the sample of methanol masers observed with VLBI in wide-field, astrometric mode. Interesting results were obtained on the nearby high mass young stellar object in Cep A. In this source the masers lie in the equatorial region around the well-known outflow source. Although the appearance is disk-like, the kinematic structure rules out masers in a rotating accretion disk. The following up studies target the VLBI sources in order to detect the presence of hyper-compact HII regions. Although most of these objects have been studied at radio wavelengths, it is possible that such (HCHII) sources have been missed, because they are only detectable at the higher frequencies. Indeed VLA observations at 22 GHz detected unknown compact emission in the source W75. Observations on the ATCA and CARMA arrays will be more conclusive on the nature of these central objects.

The new HARP facility on the JCMT allows fast studies of chemical conditions in high mass star formation. Torstensson, Hill, van der Tak (RUG) and van Langevelde started observations of a sample of high mass star formation, selected on the presence of methanol masers. High frequency thermal methanol lines can be used to quantify the temperature of the dense molecular gas and study the abundance of methanol is these objects. The data were of excellent quality and methods to derive physical quantities are being developed. Early analysis indicates that some correlation can be found between the sub-mm excitation and the presence of masers.

2.5 Stars and Circumstellar Matter

2.5.1. S Dor variables (LBVs), sgB[e]-type stars

Sterken (Brussels), van Genderen, Plummer (New Zealand) and Jones (New Zealand) started a multi-colour photometric campaign of the S Dor variable (or LBV) WRA 751 = V432 Car. This object, member of a very rare group of unstable super and hypergiants, preceding the Wolf-Rayet stage, underwent a prominent brightening phase (~ 2 magnitudes) around 2000 and reached maximum brightness (V ~ 10.5) in 2007. The last bright phase was in the 1950s, after which it faded, showing microvariations typical for this stage.

Van Genderen and Sterken (Brussels) started to analyze a large body of new and published photometric data sets (VBLUW, uvby, UBV, VRI, JHKLM) of the puzzling supergiant B[e]-type binary (P = 31d). The object shows a peculiar emission spectrum, strong UV and IR excesses, the latter due to free-free emission and to circumstellar dust. The object is intrinsically variable showing one single wave per cycle (amplitude 0.6 magnitudes), variable from cycle to cycle and is red in the maximum and blue in the minimum.

2.5.2 Evolved stars

Amiri and van Langevelde started a project to study whether departures from symmetry can be found in the circumstellar masers around normal AGB stars. The aim is to see if there are relations between the presence of magnetic fields in SiO and H2O and the departures from symmetry in the OH masers. Together with Vlemmings (Bonn Univ) a first study concentrates on MERLIN observations of objects with fast H2O flows. The group was also involved in pilot observations to evaluate whether e-VLBI techniques could be used to measure the parallax of OH/IR stars. The campaign was the first spectral-line user experiment and was technically successful. It turns out, however, to be difficult to catch bright OH emission in all objects, maybe because it is too extended, maybe because the starting positions are not accurate enough.

2.6 Structure of the Milky Way

2.6.1. Milky Way 'Bulge'

Soto, Kuijken and Rich (UCLA) are constructing a model of the stellar kinematics in the Milky Way bulge/bar. It is based on new measurements of proper motions and radial velocities from HST and the VLT, respectively. The VLT observations use an IFU to take spectra of very crowded star fields in the bulge, from which stellar spectra are then extracted using the precise position information that is measured on the HST images. Repeat HST images separated by 3--5 years allow accurate proper motions (equivalent to 30km/s accuracy at the distance of the bulge) to be measured. A separate analysis of a data set of K giants revealed a significant vertex deviation, a clear signature of bar-like kinematics, in the metal-rich stars, and was published.

2.6.2 Galactic Magnetic Field

Schnitzeler and Katgert finished the reduction of 4 WSRT datasets that are spread over the second Galactic quadrant from longitudes between 100 and 180 degrees, and at latitudes between +15 to +30 degrees, with one dataset at -25 degrees. They used the novel technique of Faraday tomography to analyse the relative distributions of Faraday rotating electrons and synchrotron emitting cosmic rays along the line-of-sight. Having information also along the depth dimension is a big improvement over previous analyses where information was only available for the line-of-sight as a whole.

An important first result is that an unexpectedly large fraction of lines-of-sight turn out to have physically separated regions with synchrotron emission and Faraday rotation. This is counter-intuitive, since the synchrotron-emitting cosmic rays are thought to pervade the entire ISM. One possible explanation could be that the magnetic field is in those cases mostly aligned with the line-of-sight: the synchrotron radiation is then emitted perpendicular to the line-of-sight, i.e. in the plane of the sky, and it would therefore be invisible for us.

Another unexpected, but very significant, result is that in 2 of the 4 datasets the rotation measures of the extragalactic sources turn out to be very different from the rotation measures of the strongest diffuse emission. In one case, the two are different by a factor of 4, and in the other case they even have different signs! This is a clear indication that the diffuse emission that we observe originates fairly close to the sun or, at least, along the near fraction of the line-of-sight through the Milky Way towards the extragalactic sources. When the signs of the rotation measures of the extragalactic sources and the diffuse emission are different, this must imply a large-scale reversal of the direction of the magnetic field somewhere along the line-of-sight. This is a bit surprising, since the dataset that shows this field reversal lies not in the Galactic plane but at a considerable Galactic latitude, viz. at b = 15 degrees. In the 2 remaining datasets the rotation measures of the extragalactic sources and the strongest diffuse emission agree quite well.

The goal of Schnitzeler's thesis work is twofold: to study the properties of the magnetized warm ISM of our Galaxy in each of the datasets individually, and also to combine the properties of these datasets to study the properties of the second Galactic quadrant as a whole. For the first goal, Schnitzeler obtained an MHD simulation from F. Heitsch (U. Michigan) and M. Haverkorn (UC/Berkeley), from which the relation between the structure in the ISM and the results of the Faraday tomography can be studied. For the latter goal, the results of the Faraday tomography are combined with lower-resolution information on the diffuse emission from the literature, and on the extragalactic sources, as provided e.g. by J. Brown (U. Calgary).

2.7 Nearby Galaxies

2.7.1. The SAURON project

De Zeeuw, Falcón-Barroso, McDermid, van den Bosch and Weijmans are members or associates of the SAURON team that has built a panoramic integral-field spectrograph for the 4.2m William Herschel Telescope on La Palma, in a collaboration which involves groups in Lyon (Bacon) and Oxford (Davies). SAURON was funded in part by a grant from NWO to de Zeeuw, and was built at Observatoire de Lyon. SAURON was used to measure the kinematics and linestrength distributions for a representative sample of 72 nearby early-type galaxies (ellipticals, lenticulars, and Sa bulges, in clusters and in the field). The entire survey was completed in 2003, and since then several follow-up projects were carried out on specific targets. In parallel with the data taking, the team developed a number of tools that are key to analyse all the resulting maps.

Falcón-Barroso, together with de Zeeuw, completed the study of the stellar populations of the representative sample of 24 Sa galaxies part of the the SAURON survey. The analysis showed that many galaxies contain some younger populations (< 1 Gyr), distributed in small or large inner discs, or in circumnuclear star forming rings. They found that the central regions of Sa galaxies display a wide range in ages, even within the galaxies. The central regions of early-type spirals are often dusty, with a good correlation between the presence of young central stellar populations and a significant amount of dust extinction. The sample has a considerable scatter in the Mgb-σ relation (considered to be a relation for the oldest local galaxies), with the largest scatter at the lowest ages. This is in disagreement with highly inclined samples, in which generally only old stellar populations are found in the central regions. This discrepancy can be understood if the central regions of Sa galaxies contain at least two components: a thin, disc-like component, often containing recent star formation, and another, ellipticallike component, consisting of old stars and rotating more slowly, dominating the light above the plane. The kinematical results confirmed this picture.

Van den Bosch and the SAURON team started constructing triaxial dynamical models of the thirteen galaxies from the SAURON sample with a kinematically decoupled core, which are thought to be triaxial. By combining the SAURON observations and the triaxial Schwarzschild

method developed in Leiden the orbital structure and intrinsic shapes of these objects can be studied for the first time. While the modeling is still ongoing, the first results indicate that most of these object are near oblate shape, while only some are significantly more triaxial.

2.7.2. The Atlas 3D project

The Atlas 3D Survey (PIs: McDermid (Leiden), Emsellem (Lyon), Cappellari and Krajnović (Oxford)) of a complete, volume-limited sample of early-type galaxies using the integral-field spectrograph SAURON on the WHT, continues to gather momentum. 2007 saw the completion of two of the four observing runs, with 17 nights of clear skies on La Palma. The project also launched an observational campaign to measure molecular and neutral gas components of these galaxies using the IRAM 30m telescope (PI Combes, Paris) at Pico Veleta, Spain and the Westerbork Synthesis Radio Telescope (PI Morganti, ASTRON) at Dwingeloo, the Netherlands. Together with complementary imaging data from the Sloan Digital Sky Survey and Isaac Newton Telescope, and archival data from Chandra, GALEX and Spitzer, this project aims to provide a broad but detailed view of our local early-type galaxy population, creating a local benchmark for studies of galaxy formation and evolution.

Observations will be completed in early 2008. This survey has Large Program status at the WHT, and as such constitutes a legacy survey for the WHT community. Reduced data and derived products will be made publicly available 12 months after the final data are taken, creating the world's largest available database of fully-calibrated integral-field spectroscopic data. The collaboration includes Leiden co-investigators de Zeeuw and Falcón-Barroso, and associates Weijmans and van den Bosch, as well as additional international collaborators.

2.7.3. Matter Distribution in the Outskirts

Weijmans reduced integral-field (SAURON) data taken at 3 half-light radii in the early-type galaxy NGC 821. Aim of these observations is to obtain the line-of-sight velocity distribution in the outskirts of the galaxy,

needed to constrain the mass distribution and establishing the presence of a dark matter halo. Analysis and modeling of the data is on-going.

In addition, Weijmans and Gerssen (Potsdam) obtained time to observe the outskirts of NGC 821 with the integral-field spectrograph PPAK, which has a larger field of view than SAURON. Previous attempts to observe this galaxy with this instrument were plagued by bad weather, and unfortunately, also this time no data could be taken because of weather conditions.

Weijmans together with van de Ven (Princeton) obtained a rotation curve for the early-type galaxy NGC 2974. They combined the kinematics of ionised gas (observed with SAURON) with those of Hi gas (observed with VLA), by applying an asymmetric drift correction to the ionised gas. In addition, they were able to separate the random motions caused by gravitational interaction from those caused by turbulence in the ionised gas. A dark matter halo is needed to reproduce the flat rotation curve. A pseudoisothermal sphere provides the best model; both an NFW halo and modified Newtonian dynamics fit the data marginally worse.

Welles (Nijmegen) with supervision from Weijmans, analysed the velocity field of both the ionised and neutral gas in the Sa galaxy NGC 1056. The ionised gas was observed with SAURON, and the neutral gas with the WSRT. He extracted a rotation curve, and constructed a mass model of this galaxy, assuming a maximal disc model. His model requires a dark matter halo, and an isothermal sphere fits the observed rotation curve marginally better than an NFW profile. The dark matter fraction in this galaxy is estimated at 90 per cent. Szomoru, with supervision from Weijmans, performed a similar analysis on the Sa galaxy NGC 2273. He also extracted a rotation curve from both the ionised gas (SAURON) and the neutral gas (WSRT). Results indicate the presence of a dark matter halo, and a more detailed analysis of the velocity fields is on-going.

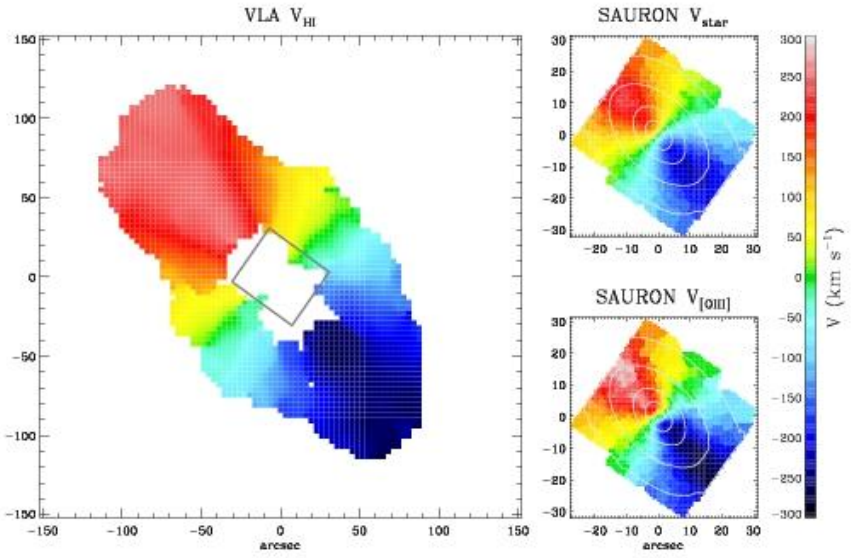

Figure 3: Velocity maps of the neutral hydrogen (VLA) and ionised gas and stars (SAURON) in early-type galaxy NGC 2974. The grey box in the VLA map encloses the SAURON fields shown at the right. The neutral and ionised gas are well aligned, indicating that they form a single disc. By extracting the rotation curves of these maps, we infer that at least 55 per cent of the matter in this galaxy is dark.

2.7.4. Dynamical Models and Analytic Methods

Geerts, with supervision from van den Bosch, added the light absorption effects of dust to dynamical models of stellar systems. Dust in galaxies can absorb a significant portion of the stellar light and thus strongly affect the observed stellar kinematics. By constructing a dynamical model that incorporates the dust absorption, it is possible to reconstruct the geometry of the dust and get a better estimate of the intrinsic properties of stellar orbits in and behind the dusty region. As a proof of concept, this new method was applied to the spiral galaxy NGC 4526, which has a strong dust disc.

Van den Bosch and de Zeeuw, together with van de Ven (Princeton) and Cappellari (Oxford), finished development of the Schwarzschild orbit superposition software for triaxial galaxies. This flexible and efficient modeling technique uses orbital families to describe a galaxy, and can be used to fit the observed light and kinematics of stellar systems in order to derive the dynamical structure, mass-to-light ratio, viewing angle and mass of the central black hole. This code, developed in Leiden, is the only existing orbit-based Schwarzschild code that can model galaxies with triaxial geometries, allowing features such as photometric position angle twists and kinematically decoupled components to be modelled with minimal assumptions.

After sucessfully showing that with this method it is possible to recover the intrinsic kinematical properties with a priori knowledge about the viewing angles of a galaxy, van den Bosch and van de Ven started a project to constrain the viewing angles of giant elliptical galaxies. To achieve this, they applied the triaxial modeling machinery to a large number of theoretical mock galaxies and found that the shape can be recovered reliable in most cases. By applying this extensively tested triaxial modeling technique it is now possible to study the 'fossil record' embedded in giant elliptical galaxies and determine their formation history and evolution.

Van den Bosch & de Zeeuw studied the central black holes in the nearby elliptical galaxies M32 and NGC 3379 using axisymmetric three-integral models and triaxial models, and confirmed that both methods find identical results for M32. They found that the black hole mass in NGC 3379 more than doubled, when they assumed the best-fitting triaxial intrinsic shape instead of an axisymmetric shape. This result may influence our understanding of the super massive black hole demography, as a significant fraction of the galaxies that host the most massive black holes are thought to be triaxial.

2.7.5. Star-Forming Nuclear Rings

Falcón-Barroso, together with Böker (ESTEC), Schinnerer (Heidelberg), Knapen (Tenerife) and Ryder (Epping) completed the study of star-forming nuclear rings based on integral-field near-IR SINFONI observations in a sample of 5 galaxies. They constructed maps of various emission lines that reveal the individual star forming regions ("hot spots") delineating the

rings. They derived the morphological parameters of the rings, and constructed velocity fields of the stars and the emission line gas. They proposed a qualitative, but robust, diagnostic for relative hot spot ages based on the intensity ratios of the emission lines Brγ, He I, and [Fe II]. Application of this diagnostic to the data provided tentative support for a scenario in which star formation in the rings is triggered predominantly at two well-defined regions close to, and downstream from, the intersection of dust lanes along the bar with the inner Lindblad resonance.

2.7.6. Bars

In order to gain a better understanding of galaxy evolution and its relation to star formation, Toonen, together with Falcón-Barroso, Fathi (Tenerife) and Beckman (Tenerife) studied the kinematics on large and small scales in the disc galaxy NGC 6946. With its disturbed morphology, NGC 6946 is a perfect example to study the orbital make-up of disc galaxies and origin of substructures. Toonen and collaborators modeled the velocity field by the thin disc approximation and subsequently improved on this with a model based on the harmonic expansion along tilted rings. Because of the resolution the models do not show the inner bar, but they do confirm the presence of the main bar. Furthermore, it was shown that the bars can be linked to the presence of resonance radii. Toonen applied the Tremaine & Weinberg method and found not one, but two distinct pattern speeds. This shows that the main bar rotates at a pattern speed which could be up to two times as high as that of the main pattern. From a study of luminosity vs. velocity dispersion in individual Hii regions, the star formation regions seem not to be in virial equilibrium, nor are they strongly affected by the main bar.

Falcón-Barroso supervised the research project of Adriana de Lorenzo-Cáceres, a PhD student at the Instituto de Astrofísica de Canarias on a joint visit to ESTEC and the Sterrewacht Leiden under the EARA program. The project was dedicated to study the kinematics and stellar populations of double-barred galaxies using SAURON integral-field spectroscopy.

2.7.7. Distribution of Dark Matter

Kuijken works on the distribution of dark matter in the universe, principally through analysis of stellar dynamics in galaxies, and gravitational lensing. A significant portion of this work relies on purpose-built instrumentation, viz. the Planetary Nebulae Spectrograph (PN.S) built for the William Herschel Telescope, and the wide-field camera OmegaCAM for the ESO VLT Survey Telescope.

2.7.8. The PN.S project

With the PN.S team (Douglas, Arnaboldi, Capaccioli, Coccato, Freeman, Gerhard, Merrifield, Napolitano, Noordermeer, Romanowsky) the study of elliptical galaxy halos continued. The PN.S finds, and measures velocities for, planetary nebulae (PNe) in external galaxies from a single observation. The ongoing survey typically yields 100-200 PNe per galaxy, mostly at large radii from the center where their motions are dominated by the dark matter halo potential. A dozen galaxies now have good datasets. A highlight of 2007 was the publication of the analysis on NGC3379, an elliptical galaxy with a curiously falling velocity dispersion. On the face of it the results imply a rather light-weight dark matter halo around this galaxy, but projection effects might conspire to hide most of the orbital motion in the plane of the sky. A novel "made-to-measure N-body code", NMAGIC, developed in the group of Gerhard (MPE) has been applied to the data in order to explore in more detail what modelling freedom the data still allow. A side-project of the PN.S project is kinematic maps S0 galaxies, with which the rotation and dispersion properties of the outermost stars are being investigated.

2.7.9. Weak Lensing

Weak gravitational lensing can be used to study the mass distribution around galaxies, as well as on larger scales. With this in mind the KiDS project was conceived, a large collaboration of 9 institutes in Europe (PI Kuijken) which will map 1500 square degrees of sky in good seeing conditions from Paranal with OmegaCAM on the VST. Unfortunately the telescope construction has been long delayed, with start of operations in

early 2009 considered likely at the time of writing. During 2007 preparations for KiDS continued in algorithm development for multi-colour photometry and for weak lensing measurement.

Since 2007 the KiDS project benefits from Leiden's participation in a European training network, 'DUEL', built around the scientific challenges in determining the cosmological model with weak lensing measurements. The lensing group in Leiden was fortified in the autumn of 2007 with postdocs Schrabback and Hildebrandt, and PhD students van Uitert and Welander.

2.7.10. Dust and gas in the Small Magellanic Cloud

As part of a large international team of astronomers, Israel studied infrared emission from the Small Magellanic Cloud (SMC) observed with Spitzer Space Observatory. They found that PAH abundances have large spatial variations probably represebnting the effects of photodestruction. They also cataloged about 400,000 mid- and far-infrared point sources in the SMC. The sources detected at the longest wavelengths fall into four main categories: (1) Young stellar objects bright at 5.8 microns but having very faint optical counterparts and very red mid-infrared colors; (2) carbon stars bright in the mid-infrared, mildly red colors; (3) Oxygen-rich evolved stars, bright in both the optical and the mid-infrared, with neutral colors; and (4) unreddened early B stars (B3-O9) with a large 24 micron excess. This excess is reminiscent of debris disks and is detected in only a small fraction of these stars (<~5%). The majority of the brightest infrared point sources in the SMC fall into groups 1-3.

Together with a subset of this team, Israel studied the dust content of the SMC from its far-infrared emission. They found a total dust mass of M(dust) = $3x10^5$ M(o), implying a dust-to-total-hydrogen ratio of about 1:700. Assuming the dust to trace the total gas column, they used a method pioneered by Israel to derive H2 surface densities across the SMC, and found a total H2 mass M(H2) = $3.2x10^7$ M(o) with a distribution similar to that of the CO, but more extended. On average, H2 is more extended than CO by a factor of about 1.3. The implied CO-to-H2 conversion factor over the whole SMC is X(CO)= 13×10^{21} cm^{-2} (K km $s^{-1})^{-1}$. Over the volume occupied by CO the conversion factor is lower, X(CO) = 6×10^{21} cm^{-2} (K km $s^{-1})^{-1}$, but still a few times larger than that found using virial mass

methods. The molecular peaks have H2 surface densities similar to those in Milky Way GMCs, and correspondingly low extinctions of about A(V) = 1-2 mag. For a given hydrostatic gas pressure, the SMC has a 2-3 times lower ratio of molecular to atomic gas than spiral galaxies. Combined with lower mean densities, this results in this galaxy having only 10% of its gas in the molecular phase.

2.7.11. The nucleus of Centaurus A

Together with a team headed by Meisenheimer (MPI Heidelberg), Jaffe, Israel and Raban, Röttgering investigated the origin of mid-infrared radiation from the core of the strong radio source Centaurus A. They carried out interferometric observations with the MID-infrared Interferometer (MIDI) at ESO's VLTI telescope array. The interferometric measurements were spectrally resolved in the wavelength range 8 to 13 micron and had a spatial resolution of 15 milli-arcseconds at the shortest wavelengths. The team obtained supplementary observations in the near-infrared with the adaptive optics instrument NACO, and at mm wavelengths with SEST and JCMT. They found that the mid-infrared emission from the Cen A core is dominated by an unresolved point source, and an extended component with a diameter of about 0.6 pc which is probably a thin dusty disk with its axis aligned with the radio jet. The disk contributes between 20% and 40% to the nuclear flux from Centaurus A and contains dust at about 240 K. The unresolved emission is probably dominated by a synchrotron source. with a spectrum characterized by an $F_\nu \sim \nu^{-0.36}$ power-law, cutting off exponentially towards high frequencies at $\nu_c = 8 \times 10^{13}$ Hz and becoming optically thick at about 45 GHz. The magnetic field strength was estimated at 26 microTesla. The team found evidence to doubt the often-advertised concept of a 'mis-directed BL Lac object'. The estimated thermal luminosity of the core is intermediate between the values for highly efficiently accreting AGN (e.g. Seyfert galaxies) and those of typical FR I radio galaxies. This luminosity, which is predominantly released in X-rays, is most likely generated in an Advection Dominated Accretion Flow (ADAF) and seems just sufficient to heat the dusty disk.

2.7.12. MIDI Observations of AGN

Jaffe continued his work on midInfrared interferometric observations of AGNs with the VLTI instrument MIDI in collaboration with Raban and Röttgering at Leiden, and colleagues at MPIA Heidelberg and Potsdam. At the first sight, the results for the dust structures in the Seyfert 2 galaxies NGC 1068 and Circinus look quite similar: they both contain an elongated inner component which seems to be embedded into a larger dust distribution, which is heated to about 300 K. The observed difference in torus size can be expected from the fact that NGC 1068 is about 10 times more luminous than Circinus. In both sources the inner component is aligned with the location of water masers.

Despite the apparent complexity in torus properties, the essential assumption of the unified scheme remains unchallenged: it is still possible that Seyfert 1s and Seyfert 2s are intrinsically the same class of objects. In order to verify this generic assumption, an AGN snapshot survey was carried during the guaranteed time observations of the MIDI consortium. It tried to identify all those AGN which are bright enough in the N-band to be observed with MIDI. For 10 of the 14 targets MIDI could detect interferometric fringes.

2.7.13. Starburst activity in M82

Brandl has continued the work on starburst activity in various environments, from local massive HII regions to distant ULIRGs. The studies are mainly based on observations with the Spitzer Space Telescope and involve collaborators at Cornell University and the Spitzer Science Center at Caltech. The members of the starburst group at Leiden included Brent Groves, Pedro Beirao, Juan Rafael Martinez Galarza, Bas Nefs, Wouter Spaan, and Hugo Zeballos Pinto.

PhD Student Beirao, Brandl and Groves worked on the mid-IR spectral analysis of the central region of the starburst galaxy M82. They found a good correlation of the dust extinction with the CO 1-0 emission. The emission from polycyclic aromatic hydrocarbons (PAHs) follows closely the ionization structure along the galactic disk, and the observed variations of the relative PAH feature strengths can be explained by extinction effects. The hardness of the ionization field is quite low on average and shows very

little spatial fluctuations, suggesting no significant recent epoch of starburst activity. Despite the large reservoir of dust and molecular gas in the central area of the galaxy the star formation rate appears to have decreased significantly over the last 5 Myr, suggesting that negative feedback processes limit the starburst activity.

2.7.14. Element abundances in local massive HII regions

Together with colleagues at Cornell, Brandl investigated the chemical abundances of three massive HII regions at different metallicities: NGC3603 in the Milky Way, 30Doradus in the Large Magellanic Cloud, and N66 in the Small Magellanic Cloud. Using the fine structure emission lines of [SIII], [SIV], [ArIII], [NeII], [NeIII], [FeII], and [FeIII] they found that the alpha-elements Ne, S, and Ar scale with each other, in good agreement with the abundances derived from the optical. However, the Ne/S ratio is higher than the solar value in the three giant HII regions and points toward a moderate depletion of sulfur on dust grains. The neon and sulfur abundances display a remarkably small dispersion (0.11dex in 15 positions in 30Doradus), suggesting a relatively homogeneous ISM, even though small-scale mixing cannot be ruled out.

2.7.15. Dust in low-metallicity dwarf galaxies

Brandl, together with collaborators at Cornell, continued the work on blue compact dwarf (BCD) galaxies. Deep Spitzer observations of I Zw 18, which has the second lowest metallicity measured in a star-forming object, yielded no emission from polycyclic aromatic hydrocarbons (PAHs). However, in contrast to other very low-metallicity galaxies, the 15 - 70 μm continuum emission of I Zw 18 has a much steeper slope, more characteristic of a typical starburst galaxy of solar abundance. They also extended the study to include 13 of the most metal-deficient BCDs known, and found that the mid-IR abundance measurements of neon and fur are consistent with the oxygen abundance derived from optical lines. The main result is that either the metallicities of dust-enshrouded regions in BCDs are similar to the optically accessible regions, or that -- if they are different -- they do not contribute substantially to the total infrared emission of the host galaxy.

2.7.16. Infrared properties of ultra-luminous infrared galaxies

In collaboration with colleagues from IPAC/Caltech and Cornell, Brandl investigated the mid-IR properties of a sample of about hundred ultra-luminous infrared galaxies (ULIRGs) observed with Spitzer. They found that the far-infrared spectral slope is strongly correlated with PAH equivalent width, but not with silicate optical depth. The detection of the high excitation [Ne V] line in just under half the sample implies that an AGN contributes significantly to the mid-IR flux in approximately 40% of ULIRGs. ULIRGs with moderate silicate absorption (0.8 < optical depth at 9.8microns < 2.4) are likely to be powered mainly by star formation, while ULIRGs with weak (<0.8) or strong (>2.4) silicate absorption contain an IR-luminous AGN.

2.7.17. Characterization of a ground-based line diagnostics

Together with masters student Nefs, Groves and Brandl investigated the theoretical and obervational errors by replacing the mid-IR [Ne III] line (which is unobservable from the ground) with the [S IV] line. The work, based on a large sample of objects of various types yielded a quantitative assessment of the accuracy of a key diagnostic feature to measure the hardness of the interstellar radiation field.

2.7.18. Nearby Clusters of Galaxies

Katgert and Biviano (Trieste) studied the evidence for kinematical and dynamical substructure in the clusters in the ESO Nearby Abell Cluster Survey. They devised a new method to quantify the probability that a given galaxy finds itself in cold and/or moving group within its cluster. The results of their analysis are very promising and the identification of substructures appears quite convincing. However, the performance of their method must be calibrated and for that they have used numerical simulations, in which all 6 phase-space coordinates are available, so that the real kinematical and dynamical substructure can be detected.

By projecting the 6-d information to 2+1-d (i.e. projected position and l.o.s. velocity) as in the observations, pseudo observations can be generated and the method for detecting substructure can then be applied to those. In that way, the effects of projection, i.e. dilution of substructure and contamination along the line-of-sight can be quantified. A general conclusion is that real moving substructures are more readily and reliably recovered in projection than cold substructures.

2.7.19. Starburst galaxies

The research of Van der Werf and his group has concentrated on nearby starburst galaxies, ultraluminous infrared galaxies (ULIRGs), and active galactic nuclei (AGNs). Starbursts are spectacular phenomena, which represent episodes in the evolution of galaxies characterized by the rapid conversion of gas into stars. During such a phase the host galaxy rapidly evolves in stellar and gas content, luminosity, colour, metallicity, and (often) morphology. The most spectacular starbursts occur in ULIRGs, which form stars at a rate sufficient to form a complete stellar population on a short timescale. Given their dusty nature, the objects are best studied at long wavelengths, from the near-infrared to the submillimetre.

2.7.20. Ground-based mid-infrared observations of starburst galaxies

In 2007, Van der Werf and his group studied a number of nearby starburst galaxies with the ESO/VLT using SINFONI (in NOVA Guaranteed Time) and VISIR. The SINFONI part of this work is carried out by Vermaas (PhD student supervised by Van der Werf), while the VISIR part was carried out by Snijders, who defended her PhD thesis in Leiden in 2007. A highlight of this work is the development of a "ground-based-only" set of diagnostics, in collaboration with Kewley (University of Hawaii). Ground-based mid-infrared observations are restricted to a restricted set of lines ([NeII], [ArIII], [SIII] and [SIV]), but have the advantage over observations from space of vastly superior resolution: with VISIR at the VLT, diffraction-limited resolution (0.3" at 10 micron) was routinely achieved, while the corresponding resolution with the Spitzer Space Telescope is 3". VISIR

observatations of superstarclusters in the Antennae (NGC4038/4039) show significant spectral differences with Spitzer observations, leading to quantitatively different results. This underlines the need for angular resolution in observations of this kind. The most important results are the diffuse nature of the PAH emission, which is therefore not directly related to the most recent (i.e., current) star formation, and the high densities and ionization parameters derived for the superstarclusters. These results could only be obtained with the spatial resolution provided by VISIR.

2.7.21. The nuclear black hole of Centaurus A and its environment

In 2007, Van der Werf, Reunanen and De Zeeuw completed their analysis of the circumnuclear region of the nearby radio galaxy Centaurus A. This project, led by Neumayer (MPIA Heidelberg), used SINFONI data in NOVA Guaranteed Time. With adaptive optics, the resolution was 0.12", so that the region of influence of the black hole could easity be resolved. The key results are that lines of higher excitation are more and more affected by non-gravitational motions, thus compromising earlier estimates of the black hole mass. In contrast, the H2 emission displays pure rotation in a warped but otherwise regular disk (see Fig. 4 for the velocity field). The black hole mass is determined to be 4.5×10^7 Msun, which brings Cen A in full agreement with the relation between black hole mass and velocity dispersion for galaxies. The warped molecular disk displays a number of ridges and peaks which can be interpreted as shocks or spiral arms, but which have no corresponding features in the velocity field. The disk must play a central role in feeding the nuclear black hole.

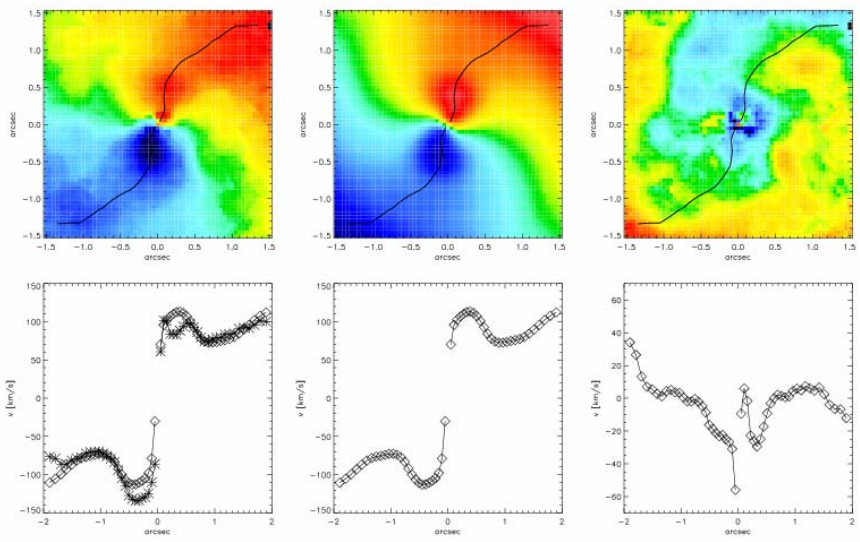

Figure 4 Velocity field of the 2.12 micron H2 line in the nuclear region of Cen A, obtained with SINFONI (Neumayer et al., 2007). The left panel shows the observed velocity field, the central panel a model with a black hole of 4.5×10^7 Msun and the right panel shows the difference between these. The black line shows the line of modes of the warped disk, along which rotation curves have been extracted, which are shown in the bottom panels (diamonds: model; crosses: data).

2.7.22. The molecular gas in the ultra-luminous infrared galaxy Mrk231

In collaboration with Papadopoulos (ETH, Zürich) and Isaak (Cardiff), Van der Werf completed his study of the warm and dense molecular gas in Mrk231. The first detections of CO(4-3) and (6-5) of a ULIRG were obtained, resulting in a fascinating new picture of the starforming interstellar medium (ISM) in this object. While in lower luminosity objects such as the Milky Way, cooling is totally dominated by the 158 micron [CII] line, in Mrk231 the total cooling by CO emission (integrated over the rotational ladder) is comparable to that by CO (see Fig. 5). This effect becomes clear only when CO (4-3) and higher lines are observed, since the warm dense gas component producing the CO cooling is totally dominates the high-J lines, while the lower-J lines are dominated by a more diffuse gas component.

Physically, these results point towards dense photon-dominated regions (PDRs), where the ionized carbon layer is thin; therefore the CO layer is located close to the source of heating and a significant column density of warm dense gas results. In Mrk231, this gas component dominates the mass budget. Given that mid-J CO lines and [CII] lines will be fundamental probes of high-z galaxies with ALMA, these results have important consequences for the interpretation of future ALMA measurements of high-z galaxies.

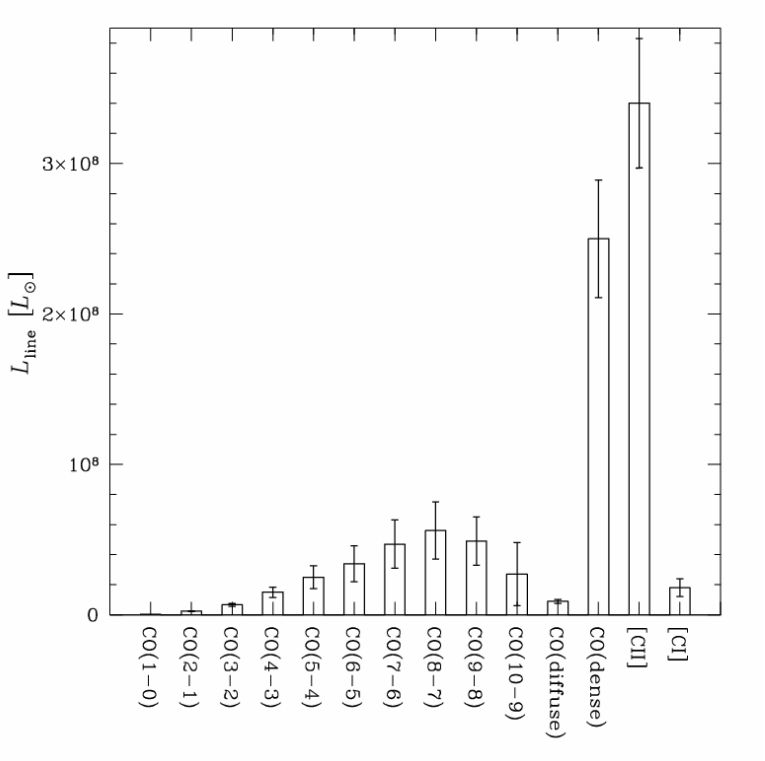

Figure 5: Cooling budget of the warm dense gas in Mrk231. Plotted are the total line luminosities of the diffuse and dense gas phases, distributed over the CO rotational ladder. the CO lines are based on measurements up to J=6-5 (except for 5-4 which is an interpolation), and error bars for these are shown. For higher lines the luminosities are based on the model derived from the lower lines. Also shown are the total CO luminosities of the diffuse and dense gas phases separately, the luminosity of the [CII] 158 micron line, and the total luminosity of the two [CI] lines (from Papadopoulos et al., 2007).

2.8 High Redshift Galaxies

2.8.1. AGN

Snellen and collaborators continued their work on the evolution of radio-loud active galactic nuclei. Together with de Vries and Schilizzi very young radio galaxies are studied, which shed new light on why certain galaxies become active and how the central activity influences the surrounding galaxy. Together with Rigby and Best (IfA, Edinburgh) the high redshift space density and cosmological evolution has been measured of Fanaroff & Riley Class I radio galaxies, indicating modest density enhancements at redshifts of >1.0.

2.8.2. Two modes of accretion in powerful radio galaxies

The XMM-Large Scale Structure field (XMM-LSS) is a 10 square degree extragalactic window observed by the XMM-Newton X-ray satellite in the 0.1 − 10 keV energy band. The XMM-LSS area has been followed up with a broad range of extragalactic surveys. Tasse, Rottgering et al. carried out low frequency radio surveys of the XMM-LSS field using the Very Large Array (Tasse et al. 2006) at 74 and 325 MHz, and the Giant Meterwave Radio Telescope (GMRT) at 230 and 610 MHz. Subsequently estimates of photometric redshifts, stellar masses, and specific star formation rates were determind for ~ 3 x 10^6 galaxies in the CFHTLS-W1 field, using the ZPEG photometric redshift code. This data set enabled them to to constrain the small (~ 75 kpc) and large (~ 450 kpc) scale environments of radio sources independently from their stellar mass estimates. Subsequent analysis showed that there are two distinct types of radio sources, whose radio source activity seem to be triggered by two different mechanisms. The first population, which dominates at high stellar masses ($M > 10^{10.5}$–$10^{10.8}$ $M_\odot$) is that of massive elliptical galaxies, lying in galaxy groups or clusters, where the radio source is triggered by the cooling of the hot gas in their atmosphere. At these stellar masses, the fraction of galaxies that host radio-loud is essentially the same as that in the local Universe. The second population of radio sources have lower stellar masses, lie in large scale underdensities, and show excess mid-IR emission consistent with a hidden

radiatively efficient active nucleus. The radio-loud fraction at these masses is increased relative to the local Universe.

The observed environmental dichotomy suggest that the activity in low stellar mass systems is driven by galaxy interactions or mergers while for the massive galaxies the activity is driven by hot gas cooling from an X-ray emitting atmosphere.

2.8.3. The Combined EIS-NVSS Survey Of Radio Sources (CENSORS)

The Combined EIS-NVSS Survey Of Radio Sources (CENSORS) is a 1.4-GHz radio survey selected from the NRAO VLA Sky Survey (NVSS) and complete to a flux density of 7.2mJy. Brookes, Best, Peacock, Röttgering and Dunlop finished spectroscopic observations of 143 of the 150 CENSORS sources. The primary motivation for these observations is to achieve sufficient spectroscopic completeness so that the sample can be used to investigate the evolution of radio sources.

2.8.4. Proto-clusters

Venemans, Röttgering, Miley and collaborators presented the results of a large program conducted with the Very Large Telescope and augmented by observations with the Keck telescope to search for forming clusters of galaxies near powerful radio galaxies at $2.0 < z < 5.2$. Narrow band imaging was used to select candidate Lyα emitting galaxies in 3×3 Mpc^2 areas near the radio galaxies. A total of 300 candidate emitters were found and follow-up spectroscopy was performed on 152 candidates in seven of the radio galaxy fields. Of these, 139 were confirmed to be Lyα emitters, four were low redshift interlopers and nine were non-detections. At least six of the eight fields are overdense in Lyα emitters by a factor 3-5 as compared to the field density of Lyα emitters at similar redshifts, although the statistics in our highest redshift field ($z = 5.2$) are poor. The protoclusters have sizes of at least 1.75 Mpc, and have masses in the range $2\text{-}9 \times 10^{14}$ $M_\odot$. The velocity dispersion of the emitters increases with cosmic time, in agreement with the dark matter velocity dispersion in numerical simulations of forming massive clusters.

2.8.5. Lyα halos

Reuland, Röttgering and Miley present the results of an optical and near-IR spectroscopic study of giant nebular emission-line halos associated with three z>3 radio galaxies, 4C 41.17, 4C 60.07, and B2 0902+34. The outer regions of these halos show quiet kinematics with typical velocity dispersions of a few hundred km s^{-1} and velocity shears that can mostly be interpreted as being due to rotation. The inner regions show shocked cocoons of gas closely associated with the radio lobes.The dynamical structures traced in the Lyα line are, in most cases, closely echoed in the carbon and oxygen lines. This shows that the Lyα line is produced in a highly clumped medium of small filling factor and can therefore be used as a tracer of the dynamics of high-redshift radio galaxies (HzRGs). It is concluded that these HzRGs are undergoing a final jet-induced phase of star formation with ejection of most of their interstellar medium before becoming 'red and dead' elliptical galaxies.

2.8.6. Galaxy Evolution

Franx and collaborators studied the evolution and formation of galaxies. This work focusses on observational studies on galaxies from z=7 to z=0, selected by a variety of techniques. This includes the study of massive galaxies at z=1.5-4, selected by near-ir imaging. This search technique enables the construction of mass selected samples at this redshift range, thereby providing a good census of the mass distribution of galaxies. Below, some of the results are described.

In collaboration with Quadri and van Dokkum (Yale University), and colleagues, the correlation function of massive red galaxies at redshift from 2 to 3 was determined. The galaxies are very strongly correlated, a result which is very difficult to model in current theories. Further confirmation using different fields is required.

Toft, Zirm, Franx and collaborators studied the sizes and star formation rates of galaxies at redshifts around 2.5. Deep imaging taken with the Hubble Space Telescope in the H-band were used to determine the sizes, and the Spitzer Telescope was used to measure star formation rates. In both fields studied (Hubble Deep Field South, and the field of MS1054-03) there was a good correlation between size and specific star formation rate:

galaxies with low specific star formation rate had small sizes, galaxies with high specific star formation rate had large sizes for their mass. This shows how strong the variety of galaxies is at high redshift, analogous to the variety seen in the local universe.

In collaboration with Holden (Santa Cruz), and collaborators, Franx studied the evolution of the morphologies in clusters. The galaxies were selected by stellar mass, estimated from the rest frame luminosities and colors. This newly defined sample showed no evolution of the morphological mix of galaxies in clusters as a function of redshift. This is very different from luminosity selected samples which do show a strong evolution. The evolution in the latter samples are caused by luminosity evolution of very low mass galaxies.

Van der Wel, Franx, and colleagues studied the evolution of morphologies of massive galaxies in the field. Similar to the result in the study described above, no evolution in the morphologies is found between a redshift of 1 and 0, if the galaxies are selected by stellar mass. Apparently, galaxies evolve along the morphology density relation, which remains rather Constant with redshift.

Bouwens, Illingworth (Santa Cruz), Franx and Ford (Baltimore) studied the evolution of the luminosity function of galaxies between a redshift of 4 and 6. Very deep fields observed with the Hubble Space Telescopes were analyzed. The luminosity functions were found to have steep slopes at all redshifts, close to -1.7. The characteristic luminosity in the UV brightens considerably from z=6 to z=4 (by 0.7 magnitude). The luminosity functions show very small evolution at the faint end, i.e., they overlap.

2.9.Theoretical Studies

2.9.1. Supermassive Black Holes and Compact Objects

In 2007, Levin has continues theoretical research into astrophysics of neutron stars and supermassive black holes. 2 major results were published in 2007:

1. Levin has worked out the theory of oscillating magnetars, and has shown how this new theory can explain observations of Quasi-Periodic Oscillations in the tail of giant magnetar flares. This makes for the first time the case of using asterosesmology to probe magnetar interiours. (published in MNRAS, 377, 159)

2. Levin has worked out a theory of formation of massive stars in black hole accretion discs, and connected this theory with the observed population of young stars in the Galactic Center. This paper also makes a prediction of a novel source of gravitational waves: an inspiral of a stellar-mass black hole, which is born in the massive accretion disc, into the disc's host supermassive black hole. This type of signal should be observable by future space-based gravitational-wave detector, LISA.

2.9.2. Detecting cosmic strings

Together with Vachaspati (Case Western Reserve) and Siemens (CalTech), Kuijken studied the effect and observability of a cosmic string when it passes in front of a distant quasar. Cosmic strings induce double images of distant sources, and boost the total detected flux even when the individual images are too close to be resolved. For sufficiently compact sources this flux increase is a factor of two. A signature of such 'microlensing' by cosmic strings is therefore a temporary doubling of the brightess of a source (see Figure 6).

The study concluded that this phenomenon will in practice be very difficult to detect, in view of (i) limits on the number and mass density of cosmic strings from the CMB fluctuation spectrum (ii) the finite size of bright quasar cores, and (iii) the attention span of even the most tenaceous astronomer.

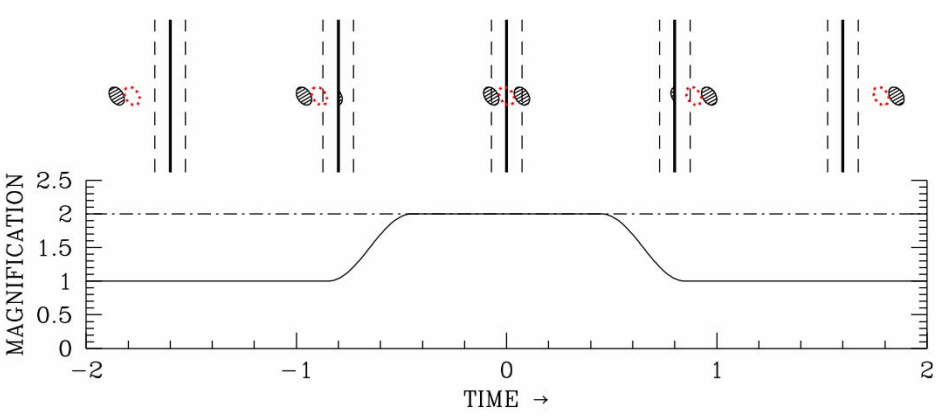

Figure 6: Microlensing by a cosmic string that passes in front of a distant, compact source. The dotted outline shows the source as it would appear without the string; the shaded images show what would be observed on the sky. The plotted lightcurve shows how the total flux detected from the source temporarily doubles as the string passes between us and the source.

2.9.3. Theory of Galaxy Formation

Simulating the formation and evolution of galaxies and the intergalactic medium

Dalla Vecchia, Duffy, Haas, Schaye, van de Voort and Wiersma, working together with Springel (MPA), Theuns (Durham) and others, used the LOFAR correlator, an IBM Bluegene/L computer, to run large-scale, cosmological, hydrodynamical simulations. The simulations were run with the code Gadget III, augmented with new modules for star formation, galactic winds, chemodynamics, and cooling. They also wrote software for the analysis of the simulations, including programs to do population synthesis and visualization and codes for the creation of halo catalogues and absorption spectra. The simulations will be used to study the formation of galaxies and the evolution of the intergalactic medium.

Radiative transfer for smoothed particle hydrodynamics simulations

Pawlik and Schaye have worked on the development of a module for the transfer of ionizing radiation radiative in the Smoothed Particle Hydrodynamics code Gadget. The method takes advantage of Gadget's parallelization scheme and runs on distributed memory systems. It is spatially adaptive and well-suited for problems with a large number of sources.

The intergalactic medium in the vicinity of Lyman-break galaxies

Rakic, Schaye, Steidel (Caltech), and Aguirre (UC Santa Cruz) have searched for correlations between the distance to Lyman-break galaxies and absorption by the intergalactic medium in the spectra of background quasars. Using pixel optical depth techniques they found that the absorption by HI, CIV, and OVI is significantly enhanced within a few comoving Mpc of the galaxies.

The small-scale distribution of intergalactic heavy elements.

Schaye, Carswell (Cambridge) and Kim (Potsdam) carried out a survey for high-metallicity CIV absorbers at redshift $z \approx 2.3$ in 9 high-quality quasar spectra. Using a novel analysis technique, based on detections of CIV lines and automatically determined upper limits on the column densities of HI, CIII, NV, and OVI, they found a large ($dN/dz > 7$) population of photo-ionized, compact ($R \sim 10^2$ pc), metal-rich ($Z \gtrsim Z_\odot$) CIV clouds with moderate densities ($n_H \sim 10^{-3.5}$ cm^{-3}), properties that they showed are robust with respect to uncertainties in the ionization model. In particular, local sources of ionizing radiation,overabundance of oxygen, departures from ionization equilibrium, and collisional ionization would all imply more compact clouds. The clouds are too small to be self-gravitating and pressure confinement is only consistent under special conditions. They argued that the clouds are, in any case, likely to be short-lived and demonstrated that this implies that the clouds could easily have been responsible for the transport of all metals that end up in the intergalactic medium (IGM). When metal-rich clouds reach pressure equilibrium with the general, photo-ionized IGM, the heavy elements will still be concentrated in small high-metallicity patches, but they will look like ordinary, low-metallicity absorbers. They concluded that intergalactic metals are poorly mixed on small scales and that nearly all of the IGM, and thus the Universe, may therefore be of primordial composition.

2.9.4. Modelling of starburst/AGN galaxies

Groves (research fellow) has worked on both AGN and starburst galaxies. Together with the IR group at MPE, he examined the shape of the silicate emission feature and the possible contribution from the narrow line region. A major work of the last year was the creation of a series of model templates for starbursting galaxies with M. Dopita of ANU, which can be used to determine fundamental physical parameters of these galaxies, such as star formation rate and ISM pressure. These studies have been accepted for publication in ApJ.

2.10. Raymond & Beverly Sackler Laboratory

The experiments in the Raymond and Beverly Sackler Laboratory for Astrophysics simulate inter- and circumstellar processes under laboratory controlled conditions. The focus is on gas phase studies of molecular transients of astrophysical interest and on solid state studies of inter- and circumstellar ice analogues. The results are interpreted in terms of unambiguous physical-chemical models to understand and to guide astronomical observations and as input in astrochemical models. Theoretical support is available to extend applications beyond experimental conclusions.

The laboratory comprises six experiments: SPIRAS and LEXUS focus on the spectra characterization of unstable (radical and ionic) species in the gas phase and CESSS, CRYOPAD, SURFRESIDE and the HV-setup are used to study the physical and chemical parameters that govern inter- and circumstellar processes in ices.

In 2007 the Laboratory group consisted of Harold Linnartz (Associate Professor for Laboratory Astrophysics), three postdocs - Guido Fuchs (until March), Herma Cuppen, and Claire Romanzin (from November) - six PhD students - Suzanne Bisschop (PhD on November 8th), Sergio Ioppolo, Karin Öberg, Nadine Wehres, Harald Verbraak, and Jordy Bouwman – and Greenberg Fellow, Zainab Awad (Egypt, until March). The group hosted undergraduate student from Maryland, USA; Martha Beckwith. The laboratory works together with the in-house astrochemistry group of Ewine van Dishoeck.

Some high-lights of 2007:

- Öberg and Bouwman succeeded to explain the anomalous behavior of vibrational water bands in astronomical observations in a systematic spectroscopic study of H_2O:CO and H_2O:CO_2 ices,
- Bisschop, Fuchs and Ioppolo were able to prove that complex molecules – methanol and ethanol – form in ice upon bombardment of CO and acetaldehyde ice,

- Cuppen extended laboratory conclusions beyond the experimental limitations using Monte Carlo simulations,
- Öberg discovered a remarkably efficient photodesorption process emitting CO into the gas phase upon XUV irradiation of interstellar CO-ice analogues,
- Acharyya and Fuchs showed that the low O_2 abundance in space is not due to invisible oxygen frozen onto dust particles.

Detailed information with experimental data, supporting links and pictures is available from the laboratory homepage: http://www.laboratory-astrophysics.eu.

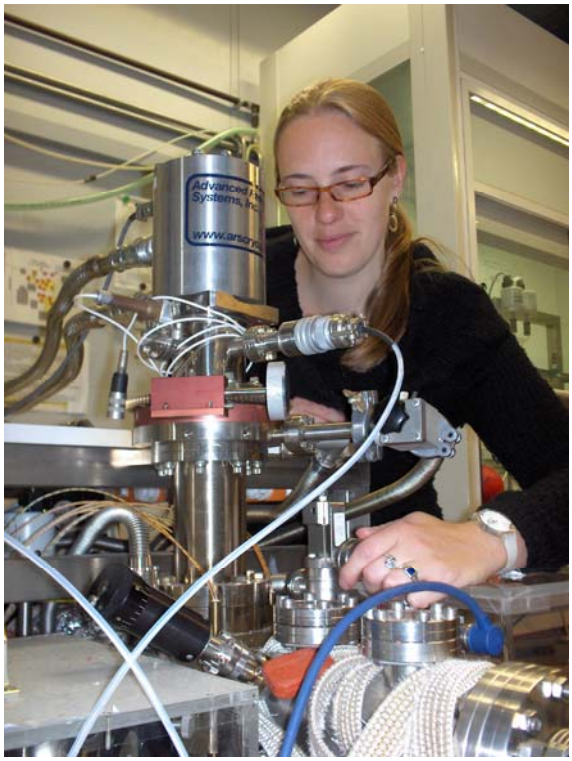

Figure 7: Preparing interstellar ice chemistry at one of the UHV setups in the Raymond and Beverly Sackler Laboratory for Astrophysics.

Al-Halabi and van Dishoeck performed classical trajectory calculations on the adsorption of H atoms to water ice at surface temperatures of 10 K. The adsorption probability as function of incident H-atom energy can be fitted to a simple decay function, with probabilities close to unity at 10 K. Very similar adsorption probabilities are found for both types of ices, even though the average binding energy of the trapped H atoms of 650 +/- 10 K for amorphous ice is significantly higher than that found for crystalline ice of 400 +/- 5 K. As a result, the residence time τ of H atoms adsorbed on amorphous ice is orders of magnitude longer than that on crystalline ice suggesting that H_2 formation on crystalline ice is quite limited compared to that on porous ice, consistent with laboratory experiments. The 'hot-diffusion' distance travelled by the impinging atom over the surface before being thermalized is found to be large, about 30 Angstrom at incident energies of 100 K. The diffusion coefficient of thermally trapped H atoms is calculated for the first time. These data are important ingredients for models to describe the formation of H_2 on interstellar ices and reactions of H atoms with other species at the ice surface.

2.11 Instrumentation

2.11.1. Gaia

Brown and Marrese are involved in the preparations for the data processing for ESA's Gaia mission, scheduled for launch in 2011, which aims at providing a stereoscopic census of the Milky Way galaxy by measuring highly accurate astrometry (position, parallaxes and proper motions), photometry and radial velocities for 1 billion stars and other objects to 20th magnitude. In the middle of 2007 the preliminary design review for the mission was successfully concluded. Brown participated in this process as a reviewer on the payload panel.

Leiden is involved specifically in the preparations of the photometric data processing for Gaia. The photometric data for Gaia will be collected through low dispersion spectrophotometry with prisms. The main activities in 2007 were:

1) The Gaia Data Processing and Analysis Consortium (DPAC) was formally recognized by ESA in the middle of 2007 and the system requirements review for DPAC was held at the end of 2007 and successfully concluded. Brown participated in the preparation of the documentation for this review.

2) Brown and Marrese in collaboration with groups in Rome and Bordeaux finalized the system requirements and the description of the data flows within and between the subsystems of the photometric processing pipeline for which Leiden leads the development. In addition they worked on the definition of the data model for the photometric processing pipeline. The data model forms an essential ingredient of the infrastructure of the pipeline.

3) Marrese studied the problem of wavelength calibration for the prism spectra, which are obtained without a wavelength reference. In collaboration with Busso (Teramo) Marrese studied the question of what fraction of sources will suffer from crowding when observed with the photometric instrument. The result is important for the assessment of the necessary processing power for and affordable complexity of the photometric data processing. Marrese also studied the problem of automatically locating the prism spectra within the data space through edge detection techniques.

4) A major concern for the Gaia mission is the effect of radiation damage to the CCDs (due to Solar wind and cosmic ray protons). The consequence will be an increased level of charge transfer inefficiency which will cause a loss of signal as well as a distortion of the image. The latter will cause systematic errors in the astrometry if not carefully controlled. A large effort is underway within the Gaia project to tackle this problem both through testing of irradiated CCDs by Astrium and the development by DPAC of data processing methods that can deal with the effects of radiation damage. In this context Brown implemented the first simulations of CTI effects in CCDs operated in time-delayed integration mode. The simulations are based on a heuristic model developed by Astrium and they have been incorporated in to the Gaia pixel level image simulator.

2.11.2. MUSE and ASSIST

MUSE, the Multi Unit Spectroscopic Explorer is a 2nd generation instrument for the VLT, featuring Wide-Field, Adaptive Optics Assisted Integral Field Spectroscopy. The MUSE Preliminary Design review took place in July 2007 and after its positive review and subsequent approval by ESO for the go-ahead, MUSE now entered its Final Design Phase. The MUSE consortium currently consists of 7 insitutes and is lead by the Observatory of Lyon. NOVA, by way of Leiden Observatory, is mainly involved in the interface between MUSE and its Adaptive Optics system (GALACSI), the preparations for scientific operation of MUSE - like the ETC and Operation and Calibration of MUSE - and the MUSE science team. MUSE is currently preparing for its Final Design Review, expected to take place in November 2008.

ASSIST - the Adaptive Secondary Setup and Instrument STimulator is the test system for the VLT Adaptive Optics Facility (AOF) and will allow for verification of the operation of the various hardware and software systems for the AOF without the need for - sometimes long - on-sky testing. ASSIST, as designed by Deep, Hallibert, Jolissaint, Kendrew, Stuik and Wiegers passed it Preliminary Design review by ESO in October 2007 and entered its final design phase. The ASSIST team is now preparing for the Final Design Review, expected to take place in June 2008.

The main results for 2007 were:
1) MUSE passed its Preliminary Design Review
2) ASSIST passed its Preliminary Design Review

2.11.3. The Mid-infrared ELT Imager and Spectrograph METIS

Brandl's main work on instrumentation - besides JWST-MIRI - focused on METIS, the Mid-infrared ELT Imager and Spectrograph (formerly called MIDIR). Following the EU-funded so-called Small Study, the Point Design Study started in November 2007 and will complete by the end of 2008. METIS is one of three instruments selected by OPTICON for such a study. The first milestone is the establishment of the detailed METIS science case, from which the top level instrument requirements will be derived. The main METIS team at Leiden includes, besides Brandl, Molster, Kendrew, Stuik, and Jolissaint on the technical side and van Dishoeck and van der Werf on the science side. In November 2007 ESO issued a call for proposals for the phase-A study of a mid-IR instrument for the E-ELT. The METIS consortium, including teams from NOVA (PI), MPIA, UK-ATC, KU Leuven and CEA-Saclay, will perform a phase-A study for this ambitious instrument.

2.11.4. LOFAR

LOFAR, the Low Frequency Array, is a next-generation low frequency radio telescope currently being constructed in the Netherlands. The initial array will comprise minimal 36 stations distributed over an area of diameter of 100 km observing in the frequency range of 10 to 240 MHz. This array is planned to be completed in 2009. Further extensions on a European scale is currently being pursued by a number of European countries, including Germany, UK, Sweden, Poland, France and Italy.

Deep LOFAR surveys of the accessible sky at a number of key frequencies will provide unique catalogues of radio sources for investigating several fundamental questions in astrophysics, including the formation of massive black holes, galaxies and clusters of galaxies. Because the LOFAR surveys will probe unexplored parameter space, it is likely that new

phenomena will be discovered. The design of the surveys has been driven by 3 important topics: (i) z>6 radio galaxies, (ii) diffuse radio emission in galaxy clusters, and (iii) distant star forming galaxies.

Early 2007, the LOFAR prototype station CS1, and its the entire imaging pipeline was in place. Beams were formed at the station level and transported to the BlueGene correlator through an optical fiber network and subsequently visibilities were produced. The hard work to understand the calibration resulted in impressive all-sky maps (see figure 8). In November 2007, the first international LOFAR station (IS DE-1) has been completed in the direct neighbourhood of the 100m Effelsberg radio telescope in a collaboration between ASTRON and MPIfR.

Members of the survey team (Intema) have carried out observation campaigns with low frequency facilities such as the GMRT to study the ionosphere and actively develop calibration strategies in collaboration with ASTRON. Mohan in collaboration with Usov released a first version of a source extraction algorithm to detect sources and measure source characteristics fitting the needs of the survey KSP and LOFAR. The software has also been tested successfully on CS1 images. Pandey and Omar are contributing to commissioning work of CS1.

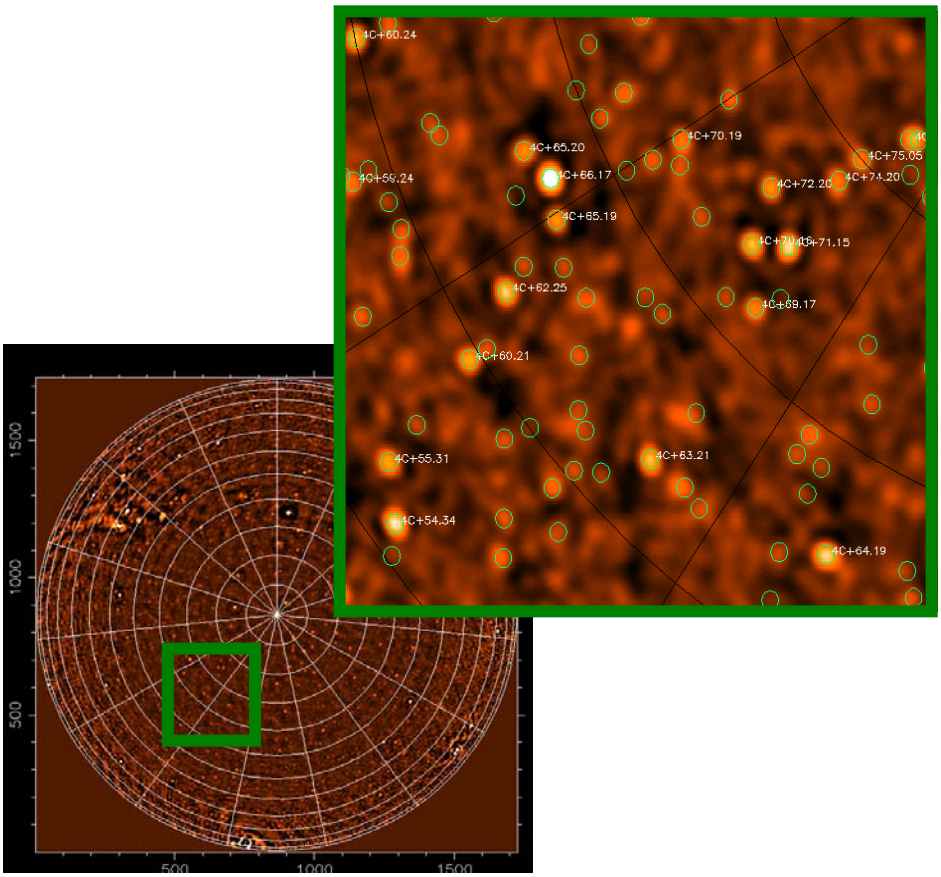

Figure 8: Images of CS1 data at 60 MHz containing about 800 sources.

2.12 History of Science

Van Delft holds an appointment of one day a week as associate professor in the history of science located at Leiden Observatory. His research in 2007 focussed on the Leiden cryogenic laboratory (Cailletet compressor, International Temperature Scale), on the later years of Paul Ehrenfest and on Gerhart Wolfgang Rathenau.

Chapter 3

Education, popularization and social events

Chapter 3

Education, popularization and social events

3.1. Education

3.1.1. Organisation

Education and training of students is a major priority of Leiden Observatory. In 2007, 18 freshmen started their studies in astronomy, and the same number of students started their second bachelor year. The total number of students registered at the Observatory was 98, including Bachelors, Masters, and old-style doctoral students. Several students from Delft Technical University (from the applied physics department) took courses of the Leiden astronomy curriculum as part of the requirements for a minor in astronomy.

The committee charged with evaluating the educational programs provided by the various schools within the Faculty of Mathematics made its site visit in January 2007. In its report later that year, it approved the astronomy program as a whole, but recommended improvements in several areas, which we are currently addressing.

Three staff members acted (part-time) as study advisers. Snellen was the freshman-student adviser and he also coordinated the various activities directed at secondary school students, such as pre-university college and LappTop courses, open days, guest lectures etc. Linnartz was study adviser for the remainder of the Bachelor programme, while Röttgering was

master-programme study advisor. Administrative support was provided by Drost and Gerstel.

In addition to regular counseling by the student advisor, incoming students were assigned to small groups meeting at regular intervals with a staff mentor (Schaye and Linnartz) and a senior student mentor (Van de Broek and Van de Sande). Freshman student tutoring was done by senior students (Breemer, Van Dalen, Smit, and six physics students). In the tutor program, physics and astronomy students are provided, on a voluntary but regular basis, with coaching by senior students.

As part of the introductory astronomy course, students were taken to the Artis Planetarium in Amsterdam for a lesson in coordinate systems, time and constellations in the sky (van der Werf). As part of the second-year training in practical astronomy, four honors students and two master students were offered the opportunity to take part in a specially arranged observing trip to the Isaac-Newton-Telescope on La Palma, Canary Islands (Snellen, Le Poole).

At the request of both astronomy and physics, the mathematics department provided, for the first time, a parallel course Analysis 3NA in which (astro)physical application of the mathematical tools is emphasized. Unlike the regular course Analysis 3, this parallel course does not prepare for Analysis 4.

At the end of the year, there were 10 old-style 'doctoraal' students and 20 master students, seven of them from outside The Netherlands. In 2007, 8 students began their master study, whereas 9 students obtained their master's degree and 13 students their 'doctoraal' degree. All master students now have their individually tailored study plan.

The astronomy curriculum is monitored by the 'Opleidingscommissie' (education committee), which advises the Director of Education on all relevant matters, and which was chaired by Van der Werf. Other members are Icke, Schaye, Intema and Damen, as well as de Valk, van den Broek, Straatman, Langelaan and Pijloo for the student body. Under the authority of the Opleidingscomissie, the lecture course monitoring system (SRS) was continued. In this system, students provide feedback to lecturers during and after the course.

The quality of curriculum and exams is guarded by the 'Examencommissie' (Exam Committee) chaired by Lub and with Israel, Groenen (physics), Hogerheijde and Van der Werf as members.

Admission to the master-curriculum for students without a BSc in astronomy from a Netherlands university requires a recommendation by the 'Toelatingscommissie' (admissions committee) chaired by Franx and having Israel, Kuijken and Röttgering as members.

3.2. Degrees awarded in 2007

3.2.1. Ph.D. degrees

A total of eight graduate students successfully defended their Ph.D. theses in 2007 and were duly awarded their Ph. D. degree: They are:

Jelle Ritzerveld	February 14
Titel thesis:	The Simplicity of Transport. Triangulating the First Light
Promotor:	Vincent Icke
Fred Lahuis	May 9
Titel thesis:	Molecular fingerprints of star formation throughout the Universe: a space-based infrared study
Promotor:	Ewine van Dishoeck
Saskia Hekker	September 18
Titel thesis:	Radial velocity variations in Red Giant Stars: Pulsations, spots and planets
Promotor:	Andreas Quirrenbach, Conny Aerts
Co-promotor:;	Ignas Snellen

Mariska Kriek	September 26
Titel thesis:	The many phases of massive galaxies. A Near-Infrared spectroscopic study of galaxies in the early universe
Promotor:	Marijn Franx, Pieter van Dokkum
Stijn Wuyts	September 27
Titel thesis:	Red Galaxies at High Redshift
Promotor:	Marijn Franx, Pieter van Dokkum
Vincent Geers	October 23
Titel thesis:	Polycyclic Aromatic Hydrocarbons in Disks around Young Solar-type Stars
Promotor:	Ewine van Dishoeck
Co-promotor:	Harold Linnartz
Suzanne Bisschop	November 8
Titel thesis:	Complex Molecules in the Laboratory and Star Forming Regions
Promotor:	Ewine van Dishoeck
Co-promotor:	Harold Linnartz
Leonie Snijders	November 28
Titel thesis:	Extreme star formation in starburst galaxies
Promotor:	Marijn Franx
Co-promotor:	Paul van der Werf

3.2.2. Master's degrees (Doctoraal diploma's)

The following 22 students were awarded Master's/Doctoral degrees in 2007:

Name	Date	Present Position
Raymond Oonk	Jan 30	Ph.D. candidate, Leiden Observatory
Maarten B. van Hoven	Feb 27	Ph.D. candidate, Leiden Observatory
Maurice Westmaas	Feb 27	Business Analyst, Accenture Consultancy
Isabel Martins e Oliveira	Feb 27	Ph.D. candidate, Leiden Observatory
Olivera Rakic	Mar 27	Ph.D. candidate, Leiden Observatory
Jochem Haverhoek	Apr 24	Secondary School Teacher
Arno Kockx	Jun 26	Softare company Tessella Support Services
Floor Roduner	Jun 26	Boston Consultancy Group
Robert Berkhout	Jun 26	ABN Amro Banking
Christopher Bonnett	Aug 28	Ph.D. candidate, Université de Paris, France
Sjoerd Ophof	Aug 28	Atlas Origin
Reinout van Weeren	Aug 28	Ph.D. candidate, Leiden Observatory
Art Bos	Sep 25	LURIS
Edo van Uitert	Oct 30	Ph.D. candidate, Leiden Observatory
Eveline van Scherpenzeel	Oct 30	Ortec Planning en Optimalisatie
Berry Holl	Oct 30	Ph.D. candidate, Lund Observatory, Sweden
Adriaan Kroonenberg	Oct 30	Management Advisor
Bart Clauwens	Nov 27	Own company
Juan Rafael Martinez Galarza	Nov 27	Ph.D. candidate, Leiden Observatory
Ernst de Mooij	Nov 27	Ph.D. candidate, Leiden Observatory
Ann Marie Madigan	Nov 27	Ph.D. candidate, Leiden Observatory
Mark den Brok	Dec 18	Ph.D. candidate, Kapteyn Institute, Groningen

3.2.3. Bachelor's degrees

A total of 9 students obtained their Bachelor's degree:

Name	Date
Tijl Kindt	Mar 23
Daniel Szomoru	May 25
Saskia van den Broek	Sep 14
Remco van den Burg	Sep 14
Meta de Hoon	Sep 14
Jesse van de Sande	Sep 14
Charlotte de Valk	Sep 14
Francis Vuijsje	Sep 14
Daniel Geerts	Sep 14

3.3 Courses and teaching

3.3.1. Courses tought by Observatory staff curriculum 2007 - 2008

Elementary courses:

Semester	Course title	Teacher
1	Introduction astrophysics	F. Israel
2	Astronomy lab 1	P.P. van der Werf
3	Stars	A. Brown
3	Modern astronomical research	H. Linnartz
4	Astronomy lab 2	I. Snellen
5	Observational techniques 1	R.S. Le Poole
5	Radiative processes	M.R. Hogerheijde
5-6	Bachelor research project	W.J. Jaffe
6	Introduction observatory	E.R. Deul
7-10	Student colloquium	Y. Levin

Advanced Courses (Keuzevakken; semesters 7, 8, 9, 10):

Active Galaxy Nuclei	H.J.A. Röttgering
Stellar Dynamics	C. Hopman
Computational Dynamics	V. Icke
Detection of Light	B. Brandl
Digital Image Processing	E.A. Hendriks and L.J. van Vliet (TUD)
Adaptive Optics in Astronomy	L. Jolissaint
Cosmology	V. Icke
Stellar Evolution	J. Lub / P.T. de Zeeuw
Space-based Astronomy	M.W.M. de Graauw
Inter University Advanced Astronomy Course on AstroParticles	H. Falcke (RU), C. Timmermans (RU), J. Hoerandel (RU), G. Nelemans (RU)
Astrochemistry	E. van Dishoeck
Physics of Scientific Space Instruments	M.W. Beijersbergen

Pre University Program

LAPP-Top, the Leiden Advanced Pre-University Program for Top Students, is aimed at enthusiastic and ambitious 5th and 6th grade high-school students. Candidates are selected on the basis of their high-school performances and their enthusiasm to participate. The LAPP-Top students have taken part in 6 to 8 meetings from January till May, following the program of their own choice.

The Sterrewacht has been participating in the LAPP-TOP program since its start in 2001. In that pilot year five students participated, in 2002/2003 six, in 2003/2004 eleven, in 2004/2005 thirty-three, in 2005/2006 seventeen, in 2006/2007 twenty-seven and in 2007/2008 sixteen.

The astronomy LAPP-TOP program was developed by Van der Werf from 2002 onward. Since 2005 the project is coordinated by Snellen. In eight sessions the following subjects were treated:

Extrasolar planets	I. Snellen
The Milky Way and other galaxies	J. Schaye
Practicum: distances in the Universe	
Gas and Radiation	V. Icke
Quasars, black holes and active galactic nuclei	H. Röttgering
Practicum: The black hole in the center of our Milky Way	
Cosmology	P. Katgert
Excursion to the radio telescopes in Westerbork and Dwingeloo	

After successfully completing the program participants have been awarded with a certificate from the University of Leiden. High-school students are allowed to use this project as part of their final exams.

Other Courses:

Katgert gave a non-credit introductory course on fourier transforms in astronomy.

Jolissaint gave a serie of lectures at TU Delft on astronomical adaptive optics for master students.

3.4. Popularization and Media Contacts

3.4.1. Organisation

Astronomy has a strong appeal to the general public, and is well represented in the media. Our staff, PhD students and undergraduate students spend considerable time and effort to explain the exciting results of astronomy to the general public, in the form of lectures, press releases and newspaper articles, courses, public days at the old observatory, and television and radio programmes. These efforts are very successful every year, and help to make young high school students enthusiastic about science in general, and astronomy in particular. They play a very important role in maintaining the student inflow, and in keeping Leiden Observatory known throughout the country.

3.4.2. Dutch Astronomy Olympiad

Leiden Observatory hosted the first Dutch Astronomy Olympiad: a contest for high school students. This Olympiad was developed and organised by the NeSO (Nederlandse Sterrenkunde Olympiade) committee, which consisted of van den Berg, Haas, Helder (Utrecht), Snellen, de Vries and Weijmans.

After a first round on the internet, (www.sterrenkundeolympiade.nl), 20 high school students were invited for a Masterclass in astronomy. During one week, they attended lectures and working classes, taught by astronomy teachers from Leiden, Groningen, Utrecht and Amsterdam. The masterclass was concluded with a final at Space Expo (Noordwijk), with Joost Broens (Leusden) as the winner. He won a digital camera and an observing trip to the 2.5m Isaac Newton Telescope at La Palma. Masha Galperina (Enschede) came second and Jorryt Matthee (Roermond) third.

Several institutions and companies sponsored the Astronomy Olympiad, among which the Ministery of Education, Culture and Science, NOVA, NWO, Leiden University and Leiden Observatory.

Media Contacts NeSO Committee:
Een minuutje (Metro, 6 March 2007)
Sterrenkunde Olympiade (Leidsch Dagblad, 9 March 2007)

Win een trip naar de sterren (AD, 10 March 2007)
Olympiade: het heelal in drie kwartier (NRC, 10 July 2007)
Radio Nens, interview Weijmans (7 July 2007)
Olympiade! (Natuurwetenschap en Techniek, September 2007)

3.4.3. Public Lectures and Media Interviews

Bouwman
'*Astronomy in space and the laboratory***'** (Technische Hogeschool Rijswijk; Sep 20)

Brandl
'Das Europäische Extremely Large Telescope'(Amateur Astronomen Club Nordenham, Germany, June 7)

Brown
'*Gaia - Een stereoscopische kaart van de Melkweg'* (Universiteit van Aruba, Aruba; Mar 1)
Idem (Colegio Arubano, Aruba; Mar 6)
Idem (KNVWS, Leeuwarden; Apr 28)
Idem (KNVWS, Zwolle; Sep 27)

de Vries
'*Het Zonnestelsel'* (St. Josephschool, Leiden; Jan 18)
'*De (on)eindigheid van het Heelal'* (Hoezo? Teleac Radio; Jun 4)

Haas
'How to grow galaxies in a computer' (International Festival for Astronomy; Nov 11)
'De vorming van sterrenstelsels' (several JWG occasions)
'Beginnerscursus Deepsky' (JWG beginnerscursus)
'Kosmologie' (several JWG occasions)
'Vorming van sterren en sterrenhopen' (several JWG occasions)

Hogerheijde
'De vorming van sterren en planeten' (gastles VWO; Feb 12)
Idem (Mar 29)
'*Waarnemingen van de vorming van sterren en planeten'* (publiekslezing; Nov 21)
Idem (Nov 27)
'*IMC Weekendschool Den Haag'* (Apr 1)

Hopman
'*De wisselwerking tussen sterren en zware zwarte gaten'* (Arnhemse vereniging voor weer- en sterrenkunde, Oct 17)

Icke
'Precisie-kosmologie' (Rotary Haarlem; Jan 24)
Interview (Weekendschool Krant; Jan 30)
'Christiaan Huygens en de wiskunde' (Natl. Wiskunde Dagen; Feb 02)
'Gas en straling' (LAPPtop; Feb 07)
'Het Heelal als leermeester' (Comenius, Groningen; Mar 16)
'*Niks relatief*' (Studium Generale, Tilburg; Mar 20)
'*Symmetrie'* (Science Café Leiden; Mar 21)
Interview (Schilperoord/Volkskrant; Mar 22)
'*Truth in science'* (DasArts Workshop, Amsterdam; Mar 28)
'*Van Aristoteles to Huygens'* (Boekhandel Donner, Rotterdam; Mar 30)
Interview (BNR Radio; Mar 31)
'*Sterrenkunde'* (Weekendschool Amsterdam ZO; Apr 01)
'*Ontstaan van sterrenstelsels'* (JWG Leiden; Apr 13)
'*Waarom is het 's nachts donker?'* (Ouderdag Sterrenkunde; Apr 14)
'*Het hele Heelal'* (Wolfert van Borselen School, Rotterdam; Apr 17)
'*Sterrenkunde'*(Weekendschool Amsterdam Noord; May 13)
'*Niks Relatief*' (Multi, Antalya; Jun 06)
Interview (Quote Magazine; Jun 12)
'*Evolutie van het Heelal'* (Op de Hoogte, Den Haag; Jun 15)
Award ceremony (Sterrenkunde Olympiade, ESTEC; Jul 07)
'Sterrenkunde' (Weekendschool Amsterdam West; Sep 23)
'Donkere materie en energie' (Museum Boerhaave; Oct 17)
Interview (RVU; Oct 29)
'*Het Heelal als leermeester'* (Comenius, Groningen; Nov 16)

'Het ontstaan van het Heelal' (Jong Diligentia, Den Haag; Nov 12)
'Was er wel een Oerknal?' (Eerstejaarssymposium Leidsche Flesch; Nov 19)
'Ruimtereizen met Huygens' (SV Arago, TU Twente; Nov 21)
'Christiaan Huygens als ruimtevaarder' (Cleveringa Lezing, Brussel; Nov 26)
'Was er wel een Oerknal?' (Van der Waals Symposium; Dec 18)

Intema
'*Speuren naar groepen sterrenstelsels in het jonge heelal'* (Oral Presentation Sterrenwacht Almere; Mar 27)
Idem (Vereniging voor Sterrenkunde Midden-Limburg, Roermond; June 10

Israel
'China's Antisatellietwapen' (VPRO Nieuwsradio, Feb 2)
'Wat doet een sterrenkundige?' (Witte School Noordwijk, Apr 26)
'50 Years after Sputnik' (FWN Leiden, Oct 4)
Idem (HoeZo Teleac Radio, Oct 4)

Katgert
'Terugkijken naar de Oerknal' (Theresia Lyceum Tilburg; Feb 14)
Idem (Vechtdal College Hardenberg; Dec 13)
'Het Uitdijend Heelal' (Kennemerland College Beverwijk; Mar 23)
Idem (OSG De Ring van Putten Spijkenisse; Mar 30)
Idem (Oosterlicht College Nieuwegein; May 8)
Idem (College Het Loo Voorburg; May 31)
Idem (Farel College Ridderkerk; June 4)
Idem (De Goudse Waarden Gouda; Oct 10)
'Moderne Kosmologie' (HOVO Leiden; Feb 22, Mar 3, Mar 8, Mar 15, Mar 22, Mar 29, Apr 5, Apr 12, Apr 19)
'Ons Huidig Wereldbeeld' (HOVO Leiden; Aug 20)
'Kosmologie: de film van het Heelal' (HOVO Delft; Mar 28)

Kuijken

'Tasten in het duister' (Margiet van der Heyden in NRC; Jan 20)
'Hoe werkt een zwaartekrachtlens?' (Bruno Ernst Symposium, Leiden; Mar 27)
'Changing the Guard' (Universiteit Leiden Nieuwsbrief; Jul 3)

'*Donkere Materie: Zoeken, maar waarnaar?'* (Jos Engels in Trouw-de verdieping; Jul 25)
'*Wat doet een astronoom?'* (interview Bassisschoolproject de Driehoek, Barendrecht; Sep 26)
'*Hoe groot is de ruimte?'* (Montessorischool, Oegstgeest; Nov 20)

Linnartz
Observatory representative press releases. Press releases 2007:
'*Fotonen in het vroege heelal waren niet nuchter'*
'Nederlandse Sterrenkunde Olympiade van start'
'Ultraviolet licht pusht chemie tussen de sterren'
'Sterbevingen laten rode reuzen rillen'
'Neon licht maakt reclame voor planeetvorming'
'Sterrenstelsels lijden onder jeugdtrauma'
'Astrochemici vinden alcohol in kosmische cocktail'
'Leidse studenten ontdekken mogelijk exoplaneet'
'*Vingerafdrukken van het heelal'*

Ödman
'*Total Lunar Eclipse Skypecast'* (Internet broadcast, Mar 3)
'How to become an astronomer' (Discussions with pupils, South African National Science Week, May 13–20)
Observing sessions with local communities in Sutherland (Sutherland, South African National Science Week: May 13–20)

Salter

'Observing at Mauna Kea' (Public Talk, Mauna Kea Observatory Visitor's Center, Nov 4)

Schaye
'*De Melkweg'* (Lezing Studium Generale TU Delft; Sep 4)

Smit
'*Licht van Gewicht: Gravitationele Lenzen en Donkere Materie'* (Public Lecture AWSV Metius; April 27)

Idem (Public Lecture KNWVS Hoorn; May 11)
'*Kosmische Samenzweringen: Waarom Wij?*' (Public Lecture KNWVS Zaanstreek; May 24)

Snellen
'*Zijn wij alleen'* (Science Cafe Nijmegen, Oct 16)
Studenten ontdekken mogelijke exoplaneet (radio, newspapers, tv, press release Nov 6)

van Bemmel
'*Radio-astronomie met de Low Frequency Array'* (KNVWS talk, Roermond, Mar 11)
Idem (KNVWS talk, Leiden Sep. 28)
'*Radio sterrenkunde'* (JWG Leiden, Nov 9)

van Delft
'*Over het nut van kranenvet'* (Werkgroep materiële cultuur van wetenschap, Museum Boerhaave, Jan 19)
'*Preventing Theft: The Kamerlingh Onnes Laboratory in World War II'* (congres Science and World War II, Museum Boerhaave, Jan 26)
'Koude, Kunst en de Tweede Gouden Eeuw' (openingscollege 'Van Chaos tot Kosmos', Universiteit Leiden, Feb 5)
'*Flogiston: tussen alchemie en moderne scheikunde'* (Lustrumbijeenkomst Algemene Studenten Vereniging Prometheus Leiden, Mar 17)
'*Fit to Print: Science in the Newspaper'* (Lorentz Center-workshop 'Show Physics', Leiden, Mar 27)
'*Reis naar het absolute nulpunt'* (KunstWetenschapSalon 'De Nul', Leiden, Apr 12)
'*Paul Ehrenfest (1880-1933) en de zwaarte van de moderne fysica'* (Festival S5, Scheltema complex, Leiden, Apr 21)
'Dat mag in de krant', (Lezing voor masterstudenten journalistiek Rijksuniversiteit Groningen, Museum Boerhaave, Apr 27)
'*Heike Kamerlingh Onnes en de Tweede Gouden Eeuw'* (College geschiedenis van de natuurwetenschappen Universiteit Leiden, Museum Boerhaave, May 14)
'*Preventing Theft: The Kamerlingh Onnes Laboratory in World War II'* (colloquium wetenschapsgeschiedenis Universiteit van Milaan, May 16)

'*Freezing Physics: the Cailletet Compressor of Heike Kamerlingh Onnes*' (XXVI Scientific Instruments Commission Symposium, Cambridge,USA, Sep 8)
'*Einstein in Leiden*' (Rotary De Burcht, Leiden, Oct 11)
'*Dat mag in de krant: over wetenschap en de pers*' (Collegereeks 'Fysica en Samenleving', Universiteit Leiden, Oct 12)
'*Over het belang van wetenschap in een vitrine*, (Collegereeks 'Fysica en Samenleving', Universiteit Leiden, Nov 2)
'*Vliegende tapijten in de hyperruimte*' (KunstWetenschapSalon 'De Snede', Museum Boerhaave, Nov 24)

van Dishoeck
'*Van moleculen tot planeten*' (Natuurkundig Gezelschap, Utrecht, Mar 6)
'*Planeetvorming*' (Interview Mare, Mar 8)
'*Zo min mogelijk mee*' (Interview Mare, june)
Interview (Elsevier, July 7, pp. 122-124)
'*Het moleculaire heelal en HIFI*' (ESTEC, Noordwijk; Sep 11)
'*Op de oevers van het heelal*' (Interview Volkskrant, Sep 22)
'*Toponderzoek: concurrentie*' (Interview Financieel Dagblad, Oct 12
'*Van moleculen tot planeten*' (Avond van Wetenschap en Maatschappij, Den Haag; Nov 5)
'*Diepte interview Gender Awareness Participation Process*'
(Stichting NCWT, nov)
'*Van moleculen tot planeten*'(Physica, Alkmaar, Dec 3)

van Langevelde
'*e-VLBI, a real-time telescope spanning Europe*' (Leidsche fles praatje, Leiden, Feb 7)
'*Een telescoop zo groot als Europa*' (JIVE/ASTRON Open dag, Westerbork, Oct 21)

Wehres
Preparation, presentation and explanation of astronomy related experiments (The National Science Day)

Weijmans
'*Sterrenstelsels*' (KNVWS Noord-Drenthe; Feb 2)

idem (Avondje Sterrewacht; Dec 20)
'Donkere Materie' (KNVWS Amsterdam; Feb 20)
idem (KNVWS Arnhem; Feb 21)
idem (Sterrenwacht Almere; Feb 27)
idem (KNVWS Rotterdam; Sep 21)
idem (KNVWS Zuid-Holland Zuid; Nov 2)

Wuyts
'Tot de grenzen van het heelal' (Public Lecture KNVWS 's Hertogenbosch; Feb 21)
'Sterrenstelsels lijden onder jeugdtrauma' (Sterrewacht Press Release, Sep 27)

3.5 The Leidsch Astronomisch Dispuut 'F. Kaiser'

In the first half of 2007, Liviu Stirbat and Sander de Kievit constituted the Kaiser board, after Rafael Martinez and Susanne Brown left. Freeke van der Voort was appointed by the Observatory to take over the organization of the tours of the Old Observatory. Students and members of the WLS gave regular tours to visitors.

In November 2007, Kaiser organized a successful movie night with the movie 'The Dish'.

Around that time, a new board consisting of Jesse van de Sande, Saskia van der Broek, Gilles Otten and Tri Laksmana Astraatmadja was appointed, which will lead Kaiser into 2008.

3.6 Vereniging van Oud-Sterrewachters

The 'Vereniging van Oud-Sterrewachters' (VO-S; http://www.vo-s.nl/) is the official association of Sterrewacht/Observatory (ex-)affiliates. It has been in existence for over 10 years now and has seen another active year. As usual, the 140 members were offered a variety of activities. These included a social drink prior to the Oort Lecture and an annual meeting. This year, the annual meeting was held in Utrecht and involved, among others, a visit of the Sonnenborgh Observatory. At the meeting, the 'Kaiserprijs' was awarded to the 'NeSO Commission 2007' which had organised a successful astronomy competition challenge for high-school students. VO-S members also received two newsletters with Sterrewacht news and were offered an electronic member dictionary.

3.7 Werkgroep Leidse Sterrewacht

The WLS has been active at the Oude Leidse Sterrewacht since 25 years. At the request of the Astronomy Department the WLS started in 1982 to maintain and repair the historical instruments, which are, thanks to the WLS, still working and in use. Once a year the WLS organizes Open Days, which are well attended, and, on a regular base, guided tours. On March 17th 2007 the WLS celebrated its 25th anniversary at the Oude Sterrewacht. During the day several lectures were given. Besides, the WLS organized an exhibition on the Oude Sterrewacht that showed the original instruments.

Appendix I

Observatory staff December 31, 2007

Sterrewacht Leiden

Observatory staff
December 31, 2007

Appendix I

Names, e-mail addresses, room numbers, and telephone numbers of all current personnel can be found on the Sterrewacht website:

http://www.strw.leidenuniv.nl/people

Telephone extensions should always be preceded by (071) 527 …
(from inside The Netherlands) or by +31-71-527 … (from abroad)

Full Professors:

E.F. van Dishoeck	K. Kuijken
M. Franx	G.K. Miley (KNAW)
V. Icke	P.T. de Zeeuw (0.0)
F.P. Israel	

Full Professors by Special Appointments:

M.A.Th.M. de Graauw	(SRON Groningen, for J.H. Oort Fund)
M.A.C. Perryman	(ESTEC, for Leiden University Fund)
H.A. Quirrenbach	(Landessternwarte Heidelberg, Faculty W&N)
R.T. Schilizzi	(ISPO, Faculty W&N)
F. van Lunteren	(UL(0.5)/VU(0.3)

Associate Professors and Assistant Professors / Tenured Staff:

B.R. Brandl	H. Linnartz
A. Brown (NWO Gaia)	J. Lub
D. van Delft (0.0) *	R.S. Le Poole (0.0)
M. Hogerheijde	H.J.A. Röttgering
W.J. Jaffe	J.Schaye
R Katgert	I.A.G. Snellen
H.J. van Langevelde (0.0) **	R. Stuik (NOVA Muse)
Y. Levin (0.8)	P.P. van der Werf

NOVA office:

E. van Dishoeck	Science director
W.H.W.M.Boland	Managing director
T. Brouwer	financial controller (0.2)
K. Groen	management assistant

Management Support and Secretaries:

J.C. Drost	A. van der Tang
K. Groen	L. van der Veld
C.C. Gündisch	B. de Kanter (voluntary)

Computer staff:

E.R. Deul	manager, computer group
D. J. Jansen	scientific programmer
T. Bot	programmer
A. Vos	programmer

Visiting Scientists:

M.J. Betlem	M. Spaans (RUG)
R. Blandford (Stanford, USA)	R. Stark (NWO)
P. Ehrenfreund (LIC)	D. Stinebring (Oberlin College, USA)
M. Jourdain de Muizon	J.A. Stüwe
J.K. Katgert-Merkelijn	S. Tremaine (IAS, USA)

Emeriti:

A. Blaauw (also: Groningen)	K.K. Kwee
W.B. Burton	R.S. LePoole
A.M. van Genderen	A. Ollongren
H.J. Habing	C. van Schooneveld
I. van Houten-Groeneveld	J. Tinbergen

* Director Boerhaave Museum; ** Staff, JIVE, Dwingeloo

Postdocs and Project Personnel:

R. Alexander	NWO	R. Köhler	NWO, VICI
I. van Bemmel	UL, EU SKADS	S. Levin-O'Donnell	UNAWE
C. Booth	NWO, EU-EXT	P. Marrese	NWO, GAIA
S.J.T. Bottinelli	NWO	R.J. Mathar	NWO, VICI
H. Cuppen	NWO, VENI	R. McDermid	NOVA, Glass
C. DallaVecchia	EU-EXT	B. Merin Martin	Spain/Spinoza
A. Deep	NOVA	C.J. Ödman	KNAW/UNAWE
J. Falćon Barroso	EU	A. Omar	NWO
G. Fuchs	NOVA, Sackler	M. Pandey	NWO, LOFAR
B. Groves	UL	R. Quadri	NOVA, UL
P. Hallibert	NOVA Muse	N.M. Ramanujam	NOVA, LOFAR
N. Hatch	UL, KNAW	J.P. Reunanen	NOVA Sinfoni
H. Hildebrandt	EU	C. Romanzin	UL/NOVA
T. Hill	NOVA	T. Schrabback	NWO
C. Hopman	NWO, VENI	O. Usov	UL, SNN LOFAR
L. Jolissaint	NOVA	R. Williams	NWO
S. Kendrew	NOVA		

Ph.D. Students:

S. Albrecht	1,9,10	O. Panic	3,5
N. Amiri *	12	A.H. Pawlik	5
J. Bast *	3	F. Petrignani	7
P. Beirao	1	T. Prod'homme *	5
R. van den Bosch	3	D. Raban	3
J. Bouwman	8	O. Rakic	3
C. Brinch	3,5	H. Rampadarath *	12
M. Damen	1,2	D. Salter	1
M. Haas	1	D.H.F.M. Schnitzeler	3
R. van Haasteren *	3	D.M. Smit	3
M. van Hoven *	1	M.H.Soto Vicencio	1
H. Intema	2,6	L. van Starkenburg (0.8)	1,2
S. Ioppolo	2	C. Tasse	1
T. van Kempen	3,4	K. Torstensson	12
C. Kruip *	2	E.N. Taylor	3
E. Kuiper *	3	E. van Uitert *	1
D.J.P. Lommen	2	M. Velander *	5
A.M Madigan *	3	H.E. Verbraak	8
J.R. Martinez Galarza	2	L. Vermaas	2
F. Maschietto	3	R.Visser	4
E. Micelotta	1,5	N.deVries	1
E. de Mooij	1	R. van Weeren *	1,6
K.I. Öberg	5	N. Wehres	13
I. Oliveira	1,4	A. Weijmans	3
R. Oonk *	1	R. Wiersma	11
J.-P. Paardekoper	2		

Funding notes:
1. funded by Leiden University; 2. funding through NOVA program; 3. funded by NWO, via Leiden University; 4. funding from Spinoza award; 5. funding by EU; 6. funding from KNAW; 7. funding by SRON; 8. employed by FOM; 9. funded by NOVA2 OPTICON; 10. funded from VICI Quirrenbach; 11. funded from EU Excellence grant; 12. funded by JIVE – EU ESTRELA netwerk; 13, funded by Groningen – EU Molecular Universe Network

* denotes employment for only part of the year - see section staff changes.

Senior Students (doct.):

N.J.C.P.Baars
B. van Dam
M. van den Berg
S.Y. Brown
E.E. Caris alias Reynders
N. ter Haar
M. Hamelink
G. van Hal
P. Herfst
S. de Kievit
C.H. van der Sluis
W.R. Spaan
R. Tan

Msc Students:

T.L. Astraatmadja
S. van den Broek
R. van der Burg
A. Jeeson Daniel
T.D.J. Kindt
S.V. Nefs
A. Rahmati
M. van Riet
S. Rusli
J. van de Sande
H. Schouten
L. Stirbat
D. Szomoru
S. Toonen
C.H.M. de Valk
F. van de Voort
F. Vuijsje
H. Zeballos Pinto

Bsc Students:

B. Beemster
B. Berwanger
T. Boekholt
Y. van Boheemen
N. Bremer
R. Buurman
M. van Daalen
H. Gorter
G. Hijmans
S. Hiltemann
J. Hoekstra
D. Huijser
I. Icke
M. Israël
A. Klaassens
N. van der Marel
T. Nak
T. Nota
W. de Pous
R. van Rooijen
I.R. Rosenbrand
W.C. Schrier
J.A.P. Severijnen
A. Shulevski
R. van der Smeede
R. Smit
J. Sprangers
P. Stout
P. Vandevelde
N. Verhart
A.W. de Vries
M. van Woerden
S. Zeegers

Note:
BSc students listed are only those from the 3rd year on.

Staff changes in 2007:

Name (funded by)	start	end
R. Alexander (NWO)	01-10-2007	
N. Amiri (JIVE, EU)	01-12-2007	
J. Bast (Spinoza, NWO)	01-04-2007	
S. Bisschop (UL, NOVA)		01-11-2007
C. Booth (NWO, EU)	01-10-2007	
E. de Mooij (UL)	01-12-2007	
A. Deep (UL, NOVA)	01-06-2007	
A. Duffy (EU)		01-07-2007
G. Fuchs (UL, NOVA)		30-06-2007
V. Geers (UL)		31-10-2007
S. Hekker (UL)		14-11-2007
H. Hildebrandt (EU)	01-11-2007	
L. Jolissaint (UL, NOVA)	01-03-2007	
S. Kendrew (UL, NOVA)	01-02-2007	
M. Kriek (NWO)		01-10-2007
C. Kruip (UL, NOVA)	01-05-2007	
E. Kuiper (NWO)	01-10-2007	
F. Lahuis (SRON, Spinoza)		01-05-2007
R. LePoole (UL)		01-12-2007
S. Levin-O'Donnell (UNAWE)	01-07-2007	
A. M. Madigan (NWO)	01-12-2007	
J.R. Martinez Galarza (UL, NOVA)	01-10-2007	
R. McDermid (UL, NOVA)		01-11-2007
E. Micelotta (EU)		14-11-2007
E. Micelotta (UL)	15-11-2007	
E. de Mooij (UL)	01-12-2007	
C. Ödman (KNAW)		30-06-2007
C. Ödman (UNAWE)	01-07-2007	
I. Oliveira (Spinoza, UL)	01-03-2007	
R. Oonk (UL)	01-02-2007	
M. Pandey (NWO)	01-06-2007	
O. Panic (EU)		14-08-2007
O. Panic (NWO)	15-08-2007	
M. Perryman	01-01-2007	
T. Prod'homme (EU)	15-09-2007	
R. Quadri (UL, NOVA)	01-11-2007	
O. Rakic (NWO)	01-04-2007	
N.M. Ramanujam (SNN-LOFAR)		30-06-2007
N.M. Ramanujam (NOVA)	01-07-2007	

H. Rampadarath (JIVE)	01-09-2007	
J. Reunanen (NOVA)		31-10-2007
J. Ritzerveld (NWO)		01-03-2007
C. Romanzin (UL, NOVA)	01-11-2007	
T. Schrabback (NWO)	01-11-2007	
L. Snijders (UL)		01-10-2007
C. Tasse (UL)		31-12-2007
S. Tremaine (J.H. Oort Fonds)	16-04-2007	20-04-2007
S. Tremaine (J.H. Oort Fonds)	28-05-2007	16-06-2007
A. van der Tang (UL)	01-02-2007	
R. van Haasteren (NWO)	01-05-2007	
M. van Hoven (UL)	01-04-2007	
F. van Lunteren (UL)	01-09-2007	
E. van Uitert (UL)	01-11-2007	
R. van Weeren (KNAW)	22-09-2007	
M. Velander (EU)	01-09-2007	
R. Visser	01-01-2007	
C. Vlahakis (NWO)	01-09-2007	
S. Wuyts		01-10-2007

Appendix

II

Committee membership

Sterrewacht Leiden

Committee membership

Appendix II

II.1. Observatory Committees

(As on December 31, 2007)

Directorate
(Directie onderzoekinstituut)
K. Kuijken (director of research)
F.P. Israel (director of education)
J. Lub (institute manager)

Observatory management team
(Management Team Sterrewacht)
K.H. Kuijken (chair)
E.R. Deul
K. Groen (minutes)
C.C. Gündisch
F.P. Israel
J. Lub

Oversight council
(Raad van Toezicht)
J.A.M. Bleeker (chair)
B. Baud
J.F. van Duyne
W. van Saarloos
vacature

Research committee
(Onderzoek-commissie OZ)
M. Franx (chair)
H. Cuppen
A.G.A. Brown
W. Jaffe
Y. Levin
P.P. van der Werf

Research institute scientific council
(Wetenschappelijke raad onderzoekinstituut)

W. Boland
B. Brandl
A.G.A. Brown
D. van Delft
E.R. Deul
E.F. van Dishoeck
M. Franx
M. Garrett
T. de Graauw
H. Habing
M. Hogerheijde
V. Icke
F.P. Israel
W.J. Jaffe (chair)
P. Katgert
K.H. Kuijken
H.J. van Langevelde
R.S. Le Poole
Y. Levin
H.V.J. Linnartz
J. Lub
F. van Lunteren
G.K. Miley
M. Perryman
A. Quirrenbach
H.J.A. Röttgering
J. Schaye
I. Snellen
R. Stuik
P.P. van der Werf
P.T. de Zeeuw

Institute council
(Instituutsraad)

E. Deul (chair)
J. Drost
F.P. Israel
W.J. Jaffe
M. Smit

Astronomy education committee
(Opleidingscommissie OC)

P.P. van der Werf (chair)
M.C. Damen
C. de Valk
J.C. Drost (minutes)
M. Franx
V. Icke
P. Langelaan
H. Linnartz
J.T. Pijloo
J. Schaye
H. Röttgering
S. van den Broek

Astronomy board of examiners
(Examencommissie)

J. Lub (chair)
E. Groenen (Physics)
F.P. Israel
M. Hogerheijde
P.P. van der Werf

Oort scholarship committee

M. Franx (chair)
F.P. Israel
H. Röttgering
J. Schaye

Mayo Greenberg prize committee

G. Miley (chair)
E.F. van Dishoeck
P. Katgert
H. Linnartz
J. Lub

MSc admission advisory committee

M. Franx (chair)
F.P. Israel
K. Kuijken
H.J. Röttgering

Graduate student review committee

(Commissie studievoortgang promovendi)
M. Franx (chair)
W. Boland
H. Linnartz
J. Schaye

Colloquia commitee

Y. Levin
J. Schaye

Computer committee

A.G.A. Brown (chair)
B. Brandl
C. Dalla Vecchia
K. Groen
C. Hopman
M. Smit
R. Williams

Library committee

W.J. Jaffe (chair)
F.P. Israel
J. Lub

Public outreach committee

F.P. Israel (chair)
V. Icke
M. Damen
T. van Kempen
N. de Vries

Social committee

M. Smit (chair)
J. Bast
A.G.A. Brown
E. Caris alias Reynders
C. Gündisch
C. Hopman
D. Raban
I.A.G. Snellen

II.2. Membership of University Committees

(As on december 31, 2007)

van Dishoeck
Chair, Faculty Research Committee (WECO)
Member, Raad van Toezicht, Leiden Institute of Physics (LION)
Member, Lorentz Center Astronomy Board

Franx
Member, Faculty Research Committee (WECO)
Director, Leids Kerkhoven-Bosscha Foundation
Director, Leids Sterrewacht Foundation
Director, Jan Hendrik Oort Foundation

Hogerheijde
Member, Board of Directors, Leids Kerkhoven-Bosscha Fonds
Member, Board of Directors, Leids Sterrewacht Fonds
Member, Board of Directors, Jan Hendrik Oort Foundation

Icke
Member, Advisory Council, Faculty of Creative and Performing Arts
Member, Belvédère Committee

Israel
Member, Committee of Education Directors, School of Sciences
Member, Board of Graduate School, School of Sciences

Jaffe
Member, Observatory Research Committee
Chairman, Observatory Scientific Council (Wetenschappelijk Raad)

Kuijken
Member, Faculty Science Committee (WECO) (-Jun)
Chair, Observatory Research Committee (-Jun)
Member, Chair, Observatory Management Team
Study Advisor BSc students (-Jul)
Chair, search Committee astronomy professor

Member, search Committee director Lorentz Centre
Member, search Committee Teylers professor of history of science
Member, search Committee Boerhave professor
Member, board of directors Leidsch Kerkhoven-Bosscha Fonds
Member, board International Center
Chairman, board of directors Leids Sterrewacht Fonds
Chairman, board of directors Oort Fonds

Linnartz
Observatory representative national science day
Observatory representative press releases
Study advisor bachelor students (2nd/3rd year) astronomy
Member, FMD/ELD user committee

Röttgering
Member, Education Committee

Snellen
Member, Leiden International Student Fund (LISF) committee
Member, Facultair Wervingsoverleg
Member, PR committee Physics/Astronomy
Member, Nederlandse Sterrenkunde Olympiade

van der Werf
Chairman, Education Committee Astronomy
Member, Joint Education Committee Physics and Astronomy
Member, Research Committee
Member, Examination Committee
Organist of the Academy Auditorium

Appendix

III

Science policy functions

Science policy functions

Appendix III

Brandl
Member, NL-PC (Dutch observing program committee)
Deputy workpackage manager, ELT Design Study WP11000 (Instrumentation)
PI, concept study of MIDIR (E-ELT mid-IR instrument)
Deputy Co-PI, European JWST-MIRI consortium
Co-Investigator, Spitzer-IRS
Member, OPTICON Key technologies working group
Chair, Scientific Organizing Committee of the Conference on '400 Years of Astronomical Telecopes'
Member, Review Panel, Deutsche Forschungs Gemeinschaft

Brown
Member, IAU Commissions 8, 37
Member, Gaia Science Team
Member, Gaia coordination unit 5 `Photometric processing' management team
Member, EU Marie-Curie RTN European Leadership in Space Astrometry (ELSA)

Franx
Chair, Nova network 1 science team
Member, MUSE science team
Member, JWST-NIRSPEC science team
Member, JWST Science Working Group
Member, ACS science team
Chair, ESO-ELT Science Working Group
Member, ESO-ELT Science and Engineering Core Working Group
Member, NL-PC Allocation Committee

Hogerheijde
Member, ALMA Science Advisory Committee
Member, ALMA European Science Advisory Committee
Member, ALMA Science Integrated Project Team
Member, ALMA Regional Center Coordinating Committee
Member, IRAM Programme Committee
Member, NWO VENI selection committee
Member, NWO/Vrije Competitie selection committee
Member, Review committee JCMT Science Archive ADP Requirements
Project scientist for CHAMP+/Netherlands
Co-Coordinator, JCMT Gould Belt Legacy Survey
Member, SOC/LOC workshop 'Scientific Exploitation of the Enhanced-SMA' (Leiden, NL; Feb 1-2)
Member, SOC NAASC workshop 'Transformational Science with ALMA: Through Disks to Stars and Planets' (Charlottesville, USA; Jun 22-24)

Icke
Member, National Committee on Astronomy Education
Member, Minnaert Committee (NOVA Outreach)
Member, Netherlands Astronomical Society Education Committee
Member, Editorial Council Natuur & Techniek
Member, Board of Directors, National Science Museum NEMO
Member, Advisory Council, Technika 10
Member, Board of Directors, Nederlands Tijdschrift voor Natuurkunde
Member, Jury 'Rubicon' (NWO)
Member, Jury P.C. Hooft Prize for Literature
Member, Jury, Annual Prize 'Wetenschap en Maatschappij'
Member of the Redactieraad, Winkler Prins 10

Israel
Member, NWO Selection Committee for VIDI Awards
Member, Panel C European Southern Observatory (ESO) Observing Programmes Committee (OPC)
Member, International Astronomical Union (IAU) Commissions 28, 40 and 51
Member, Science Team Herschel-HIFI
Member, Science Team JWST-MIRI
Member, ScienceTeam APEX-CHAMP+
Member, Editorial Board Europhysics News (EPN)

Jaffe
Director, NEVEC
Member, IAU Commission 40, 28

Chairman, ESO User's Committee
Member ESO Contact Committee
Member FITS Working Group

Katgert
Secretary/Treasurer, Leids Kerkhoven-Bosscha Fonds
Secretary/Treasurer, Leids Sterrewacht Fonds
Secretary/Treasurer, Jan Hendrik Oort Fonds

Kuijken
Advisor to National Delegate, ESO Council (Sep-)
Chair, ESO contact committee (Sep-)
Member, board of directors Kapteyn fonds
Member, bestuur ASTRON
Member, board NOVA (Jul-)
Key researcher, NOVA Dieptestrategie
Member, NOVA Instrument Steering Committee (-Apr)
Member, ESO KMOS Instrument Science Team
Member, astronomy programme board Lorentz Centre
Principal Investigator, ESO KiDS Survey
Principal Investigator, OmegaCAM project
Co-investigator, ESO VIKING Public Survey
Co-investigator, Planetary Nebulae Spectrograph project
Deputy coordinator, DUEL EU-FP6 Network
Local coordinator, EVALSO EU-FP7 programme
Member, board EARA
Member, board MICADO E-ELT instrument design study
External reviewer, DFG Schwerpunktprogram
External member, FWO-Flanders astronomy & physics programme committee
External member, Rijksuniversiteit Groningen Faculty tenure commitee

Linnartz
Workgroup leader FOM group FOM-L-027
Workgroup leader FP6 RTN program 'The Molecular Universe'
Member, FOM-NWO working group 'COMOP'
Member, CW-NWO working group 'Spectroscopy and Theory'
Member, NWO Rubicon grant allocation committee
Member, HRSMC research school
Member international scientific committee for workshop on infrared plasma spectroscopy
Editor, Comments on Atomic, Molecular and Optical Physics (part of Phys. Scripta)

Lub
Secretary, Netherlands Committee for Astronomy
Member, Board Astronomy & Astrophysics

Miley
Vice President, International Astronomical Union responsible for Education and Development
Chair, International Universe Awareness Steering Committee
Chair, LOFAR Research Management Committee
Chair, INAF Visiting Committee for Istituto di Radioastronomia (IRA)
Chair, INAF Visiting Committee for Osservatorio Astronomico di Cagliari (OAC)
Member Executive Committee International Astronomical Union
Member, LOFAR Astronomy Research Committee
Member, Board of Governors of the LOFAR Foundation
Member, Max Planck Institut fur Radioastronomie Fachbeirat
Member, Board EU SKADS Project

Röttgering
Member, Mid-Infrared interferometric instrument for VLTI (MIDI) Science Team
Member, NASA's Terrestrial Planet Finder Science Working group (TPF-SW)
Member, ESA's Terrestrial Exo-Planet Science Advisory Team (Te-SAT)
Member, LOFAR's Astronomy Research Committee
Principle Investigator, Development and commissioning of LOFAR for Astronomy (DCLA)
Member, Development and commissioning of LOFAR for Astronomy (DCLA) management team
Member, Omegacam Science team
Member, XMM Large Scale Structure Consortium
Member, SOC of EU funded graduate school 'Active Galactic Nuclei at the highest angular resolutions: Theory and Observations'
Member, SOC conference 'Astrophysics in the LOFAR Era'
Member, SOC conference 'An XXL extragalactic survey: prospects for the XMM next decade'
Member, SOC conference 'Astrophysics with E-LOFAR'
Member, Curatorium of the professorship at Leiden University 'Experimental Astroparticle physics'

Schaye
Member of the steering committee, Virgo Consortium for Cosmological Supercomputer Simulations
Co-Investigator, MUSE (Multi Unit Spectroscopic Explorer)

Co-Investigator, ISTOS (Imaging Spectroscopic Telescope for Origins Surveys)
Key researcher, NOVA (the Dutch research school for astronomy)
Member, LOFAR epoch of reionization science team
Member, MUSE science team
Member, EDGE science team (Explorer of Diffuse Emission and Gamma-ray burst Explosions)
Member, ISSI team on Non-virialized X-ray components in clusters of galaxies
NL-representative, Euro-VO Data Center Alliance, Theoretical astrophysics expert group
Chair, SOC and LOC, Lorentz Center workshop 'Computational Cosmology'
Member, Scientific Organizing Committee, IAU symposium 244: 'Dark Galaxies and Lost Baryons'
Member, National Research Initiative E-science
PI, Marie Curie Excellence Team
PI, OWLS collaboration

van Delft
Member commissie wetenschapsgeschiedenis KNAW
Member Interdisciplinary Program Board Lorentz Center / NIAS
Member adviesraad tijdschrift NWT (Natuur, Wetenschap en Techniek)
Member Scientific Organizing Committee conference '400 Years of Telescopes'
Member Scientific Organizing Committee workshop 'Artificial Cold and International Cooperation in Science', Lorentz Center
Member Raad van Advies Jaarboek KennisSamenleving
Member commissie Duizend Meesterwerken, Digitale Bibliotheek der Nederlandse Letterkunde
Ambassador Platform bètatechniek
Member begeleidingscommissie Digitaal Wetenschapshistorisch Centrum, Huygens Instituut

van der Werf
Member, JCMT Board
Chairman, JCMT Survey Oversight Committee (JSOC)
Principal Investigator, SCUBA-2 Cosmology Legacy Survey
Principal Investigator, NOVA components of SINFONI
Co-investigator, HIFI
Member, European Instrument for SPICA (ESI) study team
Member, Far-InfraRed Interferometer (FIRI) study team
Member, VISIR Science Team
Member, JWST-MIRI European Science Team
Member, METIS Study Team

van Dishoeck
Scientific Director, Netherlands Research School for Astronomy (NOVA)
Associate Editor, Annual Reviews of Astronomy & Astrophysics
Member, ALMA Board
Member, SRON Board
Member, MPIA-Heidelberg Fachbeirat
Member, INAF visiting committee Arcetri
Member, SMA Advisory Committee
Member, Spitzer Time Allocation Committee GO4
Member, Herschel-HIFI Science team
Member, ASTRONET Science Vision Panel-C
Member, VICI committee EW
Co-PI, European JWST-MIRI consortium
Chair, IAU Working Group on Astrochemistry
Member, IAU Commission 14, working group on 'molecular data'
Coordinator, Herschel-HIFI WISH Key Program
Coordinator, NOVA network II on 'Birth and Death of Stars and Planets'
Coordinator, Dutch node EU-PLANET network
Chair, Scientific Organising Committee, Science with the eSMA, Leiden
Member, Scientific Organising Committee, Molecules in Space and in the Laboratory, Paris
Member, Scientific Organising Committee, Astrophysics in the next decade: JWST and concurrent facilities, Tucson
Member, Search committee Wykeham Professor of Physics, Oxford University
Member, PhD committee D. Bodewits, RuG
Member, PhD committee D. Poelman, RuG
Member, PhD committee M. van der Loo, RU

van Langevelde
Member, ESO STC
Member, ESO VLTI overview committee
Member, ESO contactcommissie
Member, LOFAR DCLA review committee??
Member, NOVA Instrumentation Steering Committee
Member EVN board
Member, RadioNet Board and Executive Board
PI, ALBUS project
Coordinator EXPReS, board member and member management team
PI, FABRIC project
PI, SCARIe project
Member, ESTRELA board
Member SKADS board

Member PrepSKA board
Member European SKA Consortium

Weijmans
Member, National Education Committee Astronomy (LOCNOC)

Appendix

IV

Visiting scientists

Sterrewacht Leiden

Visiting scientists

Appendix IV

Name	Dates	Institute
Y. Goranova	Jan 1 - Dec 1	Max Planck Institut für Extraterrestrische Physik, Garching, Germany
J. Kurk	Jan 1–5	Max Planck Institut für Astronomie, Heidelberg, Germany
T. Theuns	Jan 8- 12	Durham University, U.K.
S. Bertone	Feb 6-12 Mar 5-30 May 30 - Jun 5 Aug 14-15	Sussex University, U.K.
B. Morgado	Mar 12 – Aug 1	University of Porto, Portugal
H. Perets	Mar 17-23	Weizmann Institute of Science, Rehovot, Israel
R. Blandford	Mar 27-30	Stanford, USA
C. Booth	April 3-7	Durham University, U.K.
S. Tremaine	April 16-20	IAS, Princeton, USA
W.D. Cotton	April 18-20	NRAO Charlottesville, USA
A. Biviano	May 21-28	Osservatorio Astronomico, Trieste, Italy
S. Tremaine	May 28 – June 16	IAS, Princeton, USA
R. Dave	June 1	University of Arizona, USA
M. Beckwith	June 1 – Aug 10	Goucher college, Maryland, USA
W. van Breugel	June 13-14	Lawrence Livermore National Lab., Livermore, USA
S. Walch	June 18-27	Ludwig-Maximilians-Universität, München, Germany

A.S. Cohen	June 18-29	Naval Research Lab., Washington, USA
M. Haverkorn	June 28	UC/Berkeley, USA
J. Bernard-Salas	July 16-25	Cornell University, USA
H. Hoekstra	Jule 21-29	University of Victoria, Canada
L. Fu	Aug 1 – Oct 29	Institute d'Astrophysique Paris, France
M. Güdel	Sep 1 – Nov 1	Institut für Astronomie, ETH Zürich, Switzerland
B.P. Venemans	Sep 10-20	IoA Cambridge University, UK
M. Merrifield	Sep 13-15	University of Nottingham, UK
P. van Dokkum	Sep 25-28	Yale, USA
R.A. Overzier	Oct 15-22	Max-Planck-Institut für Astrophysik, Garching, Germany
R. van der Marel	Oct 16-18	Space Telescope Science Institute, Baltimore, USA
W.D. Cotton	Oct 24-26	NRAO Charlottesville, USA
N. Nevasba	Nov 5-9	Meudon
A. Biviano	Nov 19-27	Osservatorio Astronomico, Trieste, Italy
A. Duffy	Nov 20-29	Manchester University, U.K.
L. Kewley	Nov 24-29	IoA, Univ of Hawaii, Hawaii, USA
T. Tepper-Garcia	Nov 28-30	Potsdam University, Germany
N. Amiri	From Dec 1	ASTRON, Dwingeloo,. Netherlands
D. Semenov	Dec 6-7	Max Planck Institut für Astronomie, Heidelberg, Germany
Y. Pavlyuchenkov	Dec 6-7	Max Planck Institut für Astronomie, Heidelberg, Germany
P. Sarre	Dec 6–7	The University of Nottingham, U.K.
A. Gurkan	many visits throughout the year	Universiteit van Amsterdam, Amsterdam, Netherlands

Appendix V

Workshops, lectures, and colloquia in Leiden

Workshops, lectures and colloquia in Leiden

Appendix V

V.1. Workshops

Most of the workshops were held in the Lorentz Center, an international center which coordinates and hosts workshops in the sciences. In 2007 the Leiden astronomers contributed to the following workshops there:

January 15 - 19
Computational Cosmology
J. Schaye, C.S. Frenk, S.D.M. White

February 1 - 2
eSMA workshop
S. Bottinelli, M. Hogerheijde, E. van Dishoeck

February 19 - 23
MUSE Busy Week
R.M. McDermid, R. Stuik

March 6 - 8
Extragalactic surveys with LOFAR
H. Röttgering, P. Barthel, G.K. Miley, R. Morganti, I. Snellen

May 29 - June 1
N-body dynamics in near-Keplerian potentials
K.H. Kuijken, Y. Levin, S. Portegies Zwart, S. Tremaine

August 6 - 17
From Massive Stars to Supernova Remnants
R.A. Chevalier, C. Fransson, N. Langer, J. Vink

September 5 - 7
MIRI
J. Blommaert, T. Lim, A. Glasse, S. Kendrew, B. Vandenbussche, T. Grundy

November 19 - 28
ELSA school on the Science of Gaia
A.G.A. Brown, L. Lindegren, M. Kontizas, C. Turon, K. Muinonen

December 10 - 12
The prospects of LOFAR surveys
H.J.A. Röttgering, P.D. Barthel, P.N. Best, R. Beck, G.K. Miley, R. Morganti, I. Snellen

V.2. Endowed Lectures

Date	Speaker (affiliation)	Title
Apr 18	Scott Tremaine (IAS, Princeton, USA)	*New Worlds: the Search for Planets ouside the Solar System* (Oort lecture)
Nov 5	Andrea Ghez (UCLA, USA)	*Bringing our Galaxy's supermassive black hole and its environs into focus with laser guide star nadaptive optics* (Sackler Lecture)

V.3. Scientific Colloquia

Date	Speaker (affiliation)	Title
18 jan	Volker Springel (MPA, Heidelberg, Germany)	*Supermassive black holes and cosmic rays in simulations of galaxy formation*
24 jan	Jelle Ritzerveld, (Sterrewacht Leiden, Netherlands)	*The simplicity of transport: Triangulating the first light*

01 feb	Steven Furlanetto (Yale University, USA)	*Cosmology at low radio frequencies: The 21 cm transition*
15 feb	Felix Aharonian (MPI-K, Heidelberg, Germany & Institute for Advanced Studies, Dublin, Ireland)	*Very high energy gamma ray sources*
19 feb	Lisa Kewley (University of Hawaii, USA)	*The Cosmic Star Formation and Metallicity History of Galaxies*
22 feb	Inga Kamp (STScI, Baltimore, USA)	*Probing protoplanetary disk evolution ... or How to make a Solar System*
26 feb	Aldo Serenelli (IAS, Princeton, USA)	*Trouble in paradise: The solar abundance problem*
01 mar	Omar Almaini (University of Nottingham, UK)	*The UKIDSS Ultra-Deep Survey: Results from year one*
02 mar	Jarle Brinchmann (Universidade do Porto, Portugal)	*The emission line properties of galaxies at low and high redshift*
05 mar	Daniel Stern (JPL, Pasadena, USA)	*Spitzer mid-infrared identification of a large population of luminous, obscured active galaxies*
07 mar	Amina Helmi (Universiteit Groningen, Netherlands)	*Cosmology with the Galaxy*
08 mar	Philip Best (University of Edinburgh, UK)	*The importance of AGN heating for elliptical galaxies and clusters*
13 mar	Joss Bland-Hawthorn (Anglo-Australian Observatory, Epping, Australia)	*The outer regions of disk galaxies: what are we learning?*
22 mar	Daniel Eisenstein (Steward Observatory, Tucson, USA)	*Dark energy and cosmic sound (NOVA colloquium)*
29 mar	Mike Irwin (Institute of Astronomy, Cambridge, UK)	*Near-field cosmology with Local Group galaxies*
30 mar	James Lloyd (Cornell University, Ithaka, USA)	*Exploring low mass stars, brown dwarfs and exoplanets with adaptive optics and precision radial velocities*
05 apr	Heino Falcke (Astron/Nijmegen, Netherlands)	*Radio detection of cosmic rays and neutrinos with LOPES & LOFAR*
12 apr	Gijs Nelemans (Universiteit Nijmegen, Netherlands)	*Ultra-compact binaries*
19 apr	Scott Tremaine (IAS, Princeton, USA)	*The long-term stability of planetary systems*

26 apr	Alice Quillen (University of Rochester, USA)	*Sculpting circumstellar disks*
03 may	Laura Ferrarese (Herzberg Institute of Astrophysics, Victoria, Canada)	*The inner workings of early-type galaxies: Cores, stellar nuclei and supermassive black holes*
07 may	Fred Lahuis (Sterrewacht Leiden, Netherlands)	*Molecular fingerprints of star formation throughout the universe - a space-based infrared study*
10 may	Steven Stahler (University of California, Berkeley, USA)	*From clouds to clusters: A tale of Orion*
24 may	Reinhard Genzel (MPE, Garching, Germany & University of California, Berkeley, USA	*High-z galaxy dynamics*
31 may	Daniel Jaffe (University of Texas, Austin, USA)	*Very low mass brown dwarfs with protoplanetary disks*
07 sep	Michael Burton (University of New South Wales, Sydney, Australia)	*The earliest stages of massive star formation*
10 sep	Saskia Hekker (Sterrewacht Leiden, Netherlands)	*Radial velocity variations of K giants: pulsations, spots and planets*
13 sep	Michael Merrifield (University of Nottingham, UK)	*21st Century galaxy dynamics (at 19th century prices)*
17 sep	Hans Kjeldsen (University of Aarhus, Denmark)	*Measurements of stellar structure through Asteroseismology*
19 sep	Stijn Wuyts (Sterrewacht Leiden, Netherlands)	*Models and observations of red galaxies at z~2.5*
20 sep	Mariska Kriek (Sterrewacht Leiden, Netherlands)	*The formation history of massive galaxies*
27 sep	Garth Illingworth (University of California Santa Cruz, USA)	*The highest redshift galaxies: Galaxy buildup in the first 2 billion years*
28 sep	Pieter van Dokkum (Yale University, New Haven, USA)	*WANTED (dead or alive): The progenitors of massive galaxies*
04 oct	Cyril Tasse (Sterrewacht Leiden, Netherlands)	*Triggering processes and evolution of AGN in the XMM-Large Scale Structure survey*
11 oct	Katherine Blundell (Oxford University, UK)	*Evolving and revolving: the relativistic jets of SS433*

17 oct	Roeland van der Marel (STScI, Baltimore, USA)	*The Dynamics of the Galaxies in the Local Group*
18 oct	Vincent Geers (Sterrewacht Leiden, Netherlands)	*Polycyclic Aromatic Hydrocarbons in disks around young solar-type stars*
25 oct	Pierre Cox (IRAM, Grenoble, France)	*The 'new' IRAM Plateau de Bure Interferometer*
29 oct	Leonie Snijders (Sterrewacht Leiden, Netherlands)	*Extreme star formation in starburst galaxies*
31 oct	Suzanne Bisschop (Sterrewacht Leiden, Netherlands)	*Complex molecules in the laboratory and star forming regions*
01 nov	Andrew King (University of Leicester, UK)	*Evolution of black hole mass and spin in active galactic nuclei*
05 nov	Andrea Ghez (UCLA, USA)	*Bringing our Galaxy's supermassive black hole and its environs into focus with laser guide star adaptive optics*
08 nov	Bruce Draine (Princeton University, USA)	*Dust Masses, PAH Fractions, and Starlight Intensities in the SINGS Galaxies*
15 nov	Eric Bell (MPIA, Heidelberg, Germany)	*The evolution of disk galaxies in a dark matter-dominated Universe*
22 nov	Floor van Leeuwen (Institute of Astronomy, Cambridge, UK)	*Exploring astrometric data*
29 nov	Francoise Combes (Paris Observatory, France)	*Some phenomena of galaxy dynamics: problems of the standard model and comparison with MOND (NOVA colloquium)*
06 dec	Peter Sarre (University of Nottingham, UK)	*The diffuse interstellar bands: The longest standing problem in astronomical spectroscopy*

V.4. Student Colloquia

Date	Speaker	Title
16 feb	Maurice Westmaas	*The Characterization of Phaseplates for an Astronomical Adaptive Optics Test Bed*
21 feb	Maarten van Hoven	*Tidal Excitation of Stellar Modes During Close Gravitational Encounters with an Intermediate Mass Black Hole*
23 feb	Isa Oliveira	*Multiwavelength Study of a New Young Stellar Population in the Serpens Molecular Cloud*
19 mar	Olivera Rakic	*Observations of the Intergalactic Medium near Lyman Break Galaxies*
24 apr	Bart Clauwens	*Full 1-loop corrections to D-term Inflation Potential*
12 jun	Floor Roduner	*Grids in the Walraven photometric system and their application to S Norma and l Carinae*
14 jun	Robert Berkhout	*Evolution of the bursting-layer wave during a Type-1 X-ray burst*
05 jul	Berry Holl	*Ionospheric calibration study for LOFAR*
10 jul	Art Bos	*IRS spectroscopy of Massive YSOs in W49A*
16 aug	Reinier Tan	*Implementation of two control algorithms on HORATIO*
23 aug	Christopher Bonnett	*Constraining Cosmology Using the Full Lensing Surface Density Obtained by Weak Lensing*
21 sep	Adriaan Kroonenberg	*Ionised gas in early-type galaxies*
02 oct	Eveline van Scherpenzeel	*How many photons are needed to ionize the Universe?*
16 oct	Edo van Uitert	*The measurement of weak gravitational lensing: STEP4 & KISS*
13 nov	Silvia Toonen	*The kinematics of the ionized gas in NGC 6946: Large and small scales*
20 nov	Susanne Brown	*PAH emission, dust emission and extinction in NGC253*

22 nov	Ernst de Mooij	*The colour-radius relation for low-redshift galaxies from the SDSS*
23 nov	Ann Marie Madigan	*Resonant Relaxation near Massive Black-Holes*
07 dec	Mark den Brok	*Atomic and molecular gas around three galactic H II regions*

Appendix

VI

Participation in scientific meetings

Participation in scientific meetings

Appendix VI

Albrecht
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
'The Rossiter-McLaughlin effect in the eclipsing binary system V1143 Cyg'

Amiri
ESTRELA Workshop (Manchester, UK; Oct 8-11)
'Circumstellar Masers of AGB stars'
Bonn-Dwingeloo High Resolution Radio Astronomy meeting (Dwingeloo, Netherlands; Oct 30)

Bast
Molecules in Space & Laboratory (Paris, France; May 14-18)
'SiS line emission as a probe of chemistry and grain formation in circumstellar envelopes of AGB stars'
Vatican Observatory Summer School on Observations and Theoretical understanding of Extrasolar Planets and Brown Dwarfs (Rome, Italy; Jun 9 - Jul 6)
'AGB stars and Planet Formation'
NOVA Fall School (Dwingeloo, Netherlands; Oct 8-12)
'Physical and Chemical structure of Protoplanetary disks'

Beirao
4th Spitzer Conference - The Evolving ISM in the Milky Way and Nearby Galaxies (Pasadena, USA; Dec 2-5)
'Spatially Resolved Spitzer-IRS Spectroscpy of the Central Region of M82'

Bisschop
Dust, gas and chemistry in space (Belfast, UK; Jan 4-5)
'Infrared spectroscopy of HCOOH interstellar ice analogues'
Molecules in Space & Laboratory (Paris, France; May 14-18)
'H-atom bombardment of HCOOH, CO2 and CH3CHO containing ices'
New astronomical challenges for surface science (Edinburgh, UK; Jun 15)
'H-atom bombradment experiments on CO2, HCOOH and CH3CHO containing ices'

Booth
Virgo Consortium Meeting (Durham, UK; Dec 17-19)
'New Additions to the OWLS Project'

Bottinelli
eSMA workshop (Leiden, Netherlands; Feb 1-2)
Molecules in Space and Laboratory (Paris, France; May 14-18)
Transformational Science with ALMA (Charlottesville, USA; Jun 22-24)
ALMA Community Meeting (Garching, Germany; Sep 3-9)
c2d meetings? (Mar 12-16 and Sep 29-Oct 2)

Bouwman
Dust, Gas and Chemistry in Space (Belfast, UK, Jan 4-5)
'Effects of CO, O2, N2 and CO2 impurities on spectroscopic features of interstellar water ice'
FOM Physics@Veldhoven (Veldhoven, Netherlands, Jan 23-24)
'A new setup for optical and near UV spectroscopy of interstellar ice analogs'
NWO CW meeting spectroscopy and theory (Lunteren, Netherlands, Jan 29-30)
'A new setup for optical and near UV spectroscopy of interstellar ice analogs'
31st Annual Scientific Meeting of the Division of Atomic, Molecular and Optical Physics of the Dutch Physical Society (Lunteren, Netherlands, Apr 4-5)
'A new setup for optical and near UV spectroscopy of interstellar ice analogs'
Molecules in Space and the Laboratory (Paris, France, May 14-18)
'A new setup for optical and near UV spectroscopy of interstellar ice analogs'
Cavity Ringdown User Meeting 2007 (Greifswald, Germany, Sep 17-19)
'A new setup for optical and near UV spectroscopy of interstellar ice analogs'
ISM/CSM meeting (Leiden, Netherlands, Oct 12)
'Spectroscopy of CO2/H2O and CO/H20 ice mixtures'

Brandl
ASTRONET strategy meeting (Poitiers, France; Jan 22-25)
'The role of starbursts in galaxy evolution: IMF and inner structure'
JW Pel Retirement Symposium (Groningen, Netherlands; Apr 13)
'Bigger is Better - mid-IR Astronomy with ELTs'

Brown
Gaia Inter-CU First Look meeting (Heidelberg, Germany; Feb 6)
' CU5 contributions to First Look processing'
Gaia Coordination Unit 3 'Core Processing' meeting (Dresden, Germany; Mar 15-16)
Gaia combined coordination unit 5 'Photometric processing' and CU7 'Variability analysis' meeting (Bologna, Italy; Mar 19-23)
Gaia Java07 workshop (Villafranca del Castillo, Spain; June 19-21)
Gaia CU5/CU5 2D imaging meeting (Brussels, Belgium; June 28)
Gaia Initial Data Treatment and First-Look meeting (Barcelona, Spain; Sep 5-6)
'Dealing with CCD radiation damage: Consequences for IDT and FL'
Gaia Coordination Unit 5 'Photometric Processing' (Leiden, Netherlands; Sep 18-19)
IAU Symposium 248: `A Giant Step:from Milli- to Micro-arcsecond Astrometry' (Shanghai, China; Oct 15-19)
'Conference summary' (invited)
ELSA school on the science of Gaia (Leiden, Netherlands; Nov 19-28)
'Interpretation of astrometric survey data'
Gaia Intermediate Data Update kick-off meeting (Heidelberg, Germany; Dec 17)

Cuppen
Dust, Gas and Chemistry (Belfast, UK; Jan 4-5)
'*Monte Carlo Simulations of Ices'*
Molecules in Space and Laboratory (Paris, France; May 14-18)
'Monte Carlo Studies of Surface Chemistry'
New Astronomical Challenges for Surface Science (Edinburg, UK; June 13-15)
'Monte Carlo Simulations of Water Ice'
ISM/CSM meeting (Leiden, The Netherlands; Oct 12)
'Monte Carlo studies of interstellar surface chemistry'

Dalla Vecchia
Computational Cosmology Workshop (Leiden, The Netherlands; Jan 15-19)
'Star forming OWLS'
Next generation of computational models of baryonic physics in galaxy formation: from protostellar cores to disk galaxies (Zürich, Switzerland; Sep 17-21)
'On the relation between the Schmidt and Kennicutt-Schmidt star formation laws'
Virgo Meeting (Durham, UK; Dec 17-19)
'Type II SN feedback in OWLS'

Damen
Galaxy Growth in a Dark Universe (Heidelberg, Germany; July 16-20)
'SIMPLE: the Spitzer/MUSYC legacy survey in the extended CDFS'

de Vries
IAU Symposium 245: Formation and Evolution of Galaxy Bulges (Oxford, UK; Jul 16-20)
'Massive Galaxies with Very Young AGN'

Franx
ESO ELT-Science Working Group (Garching, Germany; Jan 19)
Origin of Galaxies (Obergurgl, Austria, Mar 26-27)
ESO ELT-Science Working Group (Garching, Germany; Apr 2-3)
ESO ELT-ESE (Garching, Germany; Apr 3-4)
JWST Nirspec Science Team (Madrid, Spain; Apr 23-25)
The Impact of AGN Feedback on Galaxy Evolution (Ringberg, Germany; May 22-25)
ESO ELT-Science Working Group (Garching, Germany; May 28-30)
ERC review meeting (Brussels, Belgium; June 18-21)
JWST Science Working Group (Berkeley, USA; June 25-27)
Legacy of Multiwavelength Surveys (Xining, China; Aug 20-25)
ACS Science Team meeting (Jackson Hole, USA; Sep 16-22)
ESO ELT-ESE (Garching, Germany; Oct 3-4)
VLT instruments in the era of the ELT (Garching, Germany; Oct 8-11)
ERC review meeting (Brussels, Belgium; Nov 5-8)
JWST Nirspec Science Team (Lyon, France; Nov18-20)

Groves
The Origin of Galaxies (Obergurgl, Austria; Mar 24-29)
'IR Emission from the NLR: Constraining the Contribution'
Pathways Through an Eclectic Universe (Tenerife, Spain; Apr 23-27)
'Distinguishing AGN and Starformation'
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
'Do Low Metallicity AGN Exist' (Poster)
MAGPOP: Garching Spectra Workshop (Garching, Germany; May 28-31)
'Understanding the Emission Lines from SDSS'
Obscured AGN across Cosmic Time (Seeon, Germany; June 5-8)
'*IR Emission from the NLR: Constraining the Contribution of AGN'*
MAGPOP Network Meeting (Malta; Oct 29-31)
'*Controlling Parameters of the Starburst SED'*

Haas
Virgo Meeting (Leiden, Netherlands; Jan 15-19)
'*Shaping the Luminosity Function: The effect of dust attenuation'*
Gas Accretion and Star Formation in Galaxies (Garching, Germany; Sept 10-14)
Next generation of computational models of baryonic physics in galaxy formation: from protostellar cores to disk galaxies (Zürich, Switzerland; Sept 17-21)
'The importance of Dust for the Galaxy Luminosity Function'
Virgo Meeting (Durham, UK; Dec 17-19)
'*Stellar masses and star formation rates of OWLS halos & Column densities of OWLS halos'*

Hatch
Tracing Cosmic Evolution with Clusters of Galaxies: Six Years Later (Sesto, Italy; June 25-29)
'The immediate environment of a forming BCG at z=2'
Galaxy Growth in a dark Universe (Heidelberg, Germany; July 16-20)
'The immediate environment of a forming BCG at z=2'
EARA Lyman alpha workshop (Paris, France; Oct 15-17)
'*The relationship between the Lyman-alpha halo and the diffuse UV continuum surrounding a z=2 radio galaxy'*
The prospects of LOFAR surveys (Leiden, The Netherlands; Dec 10-12)

Hill
IAU 242: Astrophysical Masers and their environments (Alice Springs, Australia; Mar 12-16)
'Profiling Young Masive Stars '
CASA tutorial workshop (Garching, Germany; July 9-11)
ALMA community meeting (Garching, Germany; Sep 3-4)
Surveys for ALMA (Garching, Germany; Sep 5-6)
Massive Star Formation: Observations Confront Theory (Heidelberg, Germany; Sep 9-14)
'Identifying Young Massive Stars '
ATNF Astrofest 2007 (Sydney, Australia; Dec. 6)
'Do all massive cores form stars? A CO and CS Mopra study of southern cores'

Hogerheijde
Scientific Exploitation of the Enhanced-SMA (Leiden, Netherlands; Feb 1-2)
NOVA Science Day (Utrecht, Netherlands; Aug 27)
ALMA Community Day and Workshop on Surveys with ALMA (Garching, Germany, Sep 3-6)
'First results from the JCMT Gould Belt Legacy Survey'

Hopman
Lorentz workshop: N-body dynamics in near-Keplerian potentials (Leiden, Netherlands; May 29 - Jun 1)
'The dynamics of stellar inspiral into a massive black hole'
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands May 14-16)
'Gravitational waves from compact remnants orbiting massive black holes'
DAD07 (Leiden, Netherlands; Mar 26-27
'Resonant relaxation near massive black holes'

Intema
LOFAR Surveys Workshop (Leiden, Netherlands; Mar 6-8)
'LOFAR Ionospheric Calibration'
LOFAR Surveys Team Meeting (Leiden, Netherlands; Apr 10)
Workshop 'Astrophysics in the LOFAR Era' (Emmen, Netherlands; Apr 23-27)
Ionosphere Meeting (Leiden, Netherlands; June 22)
'Ionospheric Modeling using the Peeling Scheme'

LOFAR DCLA Project Meeting (Dwingeloo, Netherlands; June 26-27)
'*Ionospheric Modeling using the Peeling Scheme*'
LIONS Kick-off Meeting (Dwingeloo, Netherlands; Oct 9)
'*Ionospheric Modeling using the Peeling Scheme*'
IONO - LOFAR Consulting Meeting (Dwingeloo, Netherlands; Oct 17-19)
LOFAR Surveys Workshop (Leiden, Netherlands; Dec 10-12)
SKADS LIONS Long Baseline Meeting (Leiden, Netherlands; Dec 13)
'*Ionospheric Modeling using the Peeling Scheme*'

Ioppolo
Dust, Gas and Chemistry in Space (Belfast, UK, Jan 4-5)
'Laboratory study of CO ice hydrogenation'
FOM Physics@Veldhoven (Veldhoven, Netherlands, Jan 23-24)
'Laboratory study of CO ice hydrogenation'
Molecules in Space and the Laboratory (Paris, France, May 14-18)
'Laboratory study of CO ice hydrogenation'

Israel
eSMA Workshop (Leiden, Netherlands, Feb 1-2)
Herschel Open Time Key Program Workshop (Noordwijk, Netherlands; Feb 20-21)
Extragalactic surveys with LOFAR (Leiden, Netherlands; Mar 6-8)
Tracing Dust in Spiral Galaxies, ESF Workshop (Gent, Belgium; May 14-16)
ARENA Workshop on Submm Astronomy from Dome C (Saclay, France; June 25-27)
'ISM Processing in the Magellanic Clouds'
FIR Workshop 2007: Far-Infrared and Submillimeter Emission of the Interstellar Medium: Models meet extragalactic and Galactic Observations (Bad Honnef, Germany, Nov 5-9)
'The dense molecular medium in 100 galaxy nuclei'

Jaffe
ESO Calibration Workshop (Garching, Germany, Jan 24-26)
VLT in the Epoch of the ELT (Garching, Germany, Oct 10-12)

Kendrew
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
*'MIDIR: A Mid-IR Instrument for the European Extremely Large Telescope'***OSA Topical meeting on Adaptive Optics: Analysis and Methods** (Vancouver, Canada; June 18-20)
'*Adaptive Optics Challenges for Mid-IR ELT Instrumentation*'
SPIE Optics & Photonics 2007 (San Diego, USA; Aug 26-30)
'*Mid-infrared instrumentation for the European Extremely Large Telescope*'
Lorentz Center Workshop on MIRI testing (Leiden, Netherlands; Sep 5-7)
Kruip
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
Radiative transfer workshop (Durham, UK; Sep 3-7)
Adaptive-mesh simulations with FLASH (Bremen, Germany; Oct 15-18)
IAU Symposium 250 on Massive Stars as Cosmic Engines (Kauai Island, Hawaii; Dec 10-14)
'Radiative Transport Using SimpleX'

Kuijken
LOFAR Surveys (Leiden, Lorentz Center; Mar 5-8)
'Lensing with LOFAR'
Probing the Universe with Weak Lensing (Marseille, France; Apr 24-25)
'Lensing with KiDS: studying dark matter and dark energy with light rays'
The Dark Side of the Universe 07 (Minnesota, USA; Jun 5-10)
idem
From giant arcs to CMB lensing: 20 years of gravitational distortion (Paris, France; Jul 2-6)
'STEP: The shear testing programme'
STEP workshop (JPL, USA; Aug 20-24)
'Shears from shapelets'
'The KiDS Survey'
'Using the STEP4 simulations'
Weak Lensing and Photometric Redshifts (University of British Columbia, Canada; Sep 5-7)
'GaaP Photometry'
'The KiDS Survey'

DUEL Workshop (Royal Observatory Edinburgh, UK; Oct 8-9)
'Wide-field lensing surveys'
'Measuring Shear'
Astroparticle Physics Symposium #9 (Kapteyn Institute Groningen, Netherlands; Oct 12)
'Lensing with KiDS: studying dark matter and dark energy with light rays'
Cosmic Strings and Superstrings in Observational Cosmology (Astroparticle and Cosmology, Paris 7, France; Dec 10-13)
'Microlensing by Cosmic Strings'
Levin, (Sarah)
Communicating Astronomy to the Public 2007 (Athens, Greece; Oct 8-11)
'UNAWE: Humanizing Astronomy'

Linnartz
Dust, Gas and Chemistry in Space (Belfast, UK, Jan 4-5)
FOM Physics@Veldhoven (Veldhoven, Netherlands, Jan 23-24)
NWO CW meeting spectroscopy and theory (Lunteren, Netherlands, Jan 29-30)
Dutch inter/circumstellar matter meetings (Amsterdam-Feb, Leiden-Oct)
Molecular Universe Midterm Review meeting (Perugia, Italy; Mar 19-21)
Molecules in Space and Laboratory – international astrophysics and astrochemistry meeting (Paris, France; May 14-18)
1st international summer school on infrared plasma spectroscopy (Greifswald, Germany; July 23-24)
2nd international workshop on infrared plasma spectroscopy (Greifswald, Germany; July 24-27)
7th international meeting on cavity ring down spectroscopy (Greifswald, Germany; Sep 18–19)
FOM – MAP meeting (Nijmegen, Netherlands; Oct)
HRSMC research school meeting (Amsterdam, Netherlands, Nov 22)

Lommen
eSMA meeting (Leiden, Netherlands; Feb 1-2)
'Observing young disks'
Origin Of Solar Systems (Gordon Research Conference) (South Hadley, MA, USA; July 8-13)
'SMA observations of young disks: separating envelope, disk, and stellar masses in class I YSOs'

Lub
Between Cepheids and Mid IR instrumentation symposium ter ere van pensionering Prof. D. J.W. Pel (Groningen, Netherlands; Apr 13-14)
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
XXI Century Challenges for Stellar Evolution (Cefalu, Sicily, Italy; Aug 27 - Sept 3)

Maschietto
The Origin of Galaxies: Exploring Galaxy Evolution with the New Generation of Infrared-Millimeter Facilities (Obergurgl, Austria; Mar 24-29)
'*OIII emitters in HzRG*'
Tracing Cosmic Evolution with Clusters of Galaxies: Six Years Later; (Sesto (BZ), Italy; June 25-29)
'OIII emission lines in H-z protoclusters'

Miley
Workshop on LOFAR Surveys (LC, Leiden, Netherlands; March 7-9)
NRAO 50th Anniversary Conference (Charlottesville, USA; June 19–22)
50th Anniversary of Lovell Telescope (Manchester, UK; Oct 3–5)
IYA and Communicating Astronomy to the Public (Athens, Greece; Oct 10–12)
Workshop on LOFAR Surveys (LC, Leiden, Netherlands; Dec 10-13)

Öberg
Dust, Gas and Chemistry in Space (Belfast, UK, Jan 4-5)
'Photodesorption of CO ice'
FOM Physics@Veldhoven (Veldhoven, Netherlands, Jan 23-24)
'*Photodesorption of CO ice*'
31st Annual Scientific Meeting of the Division of Atomic, Molecular and Optical Physics of the Dutch Physical Society (Lunteren, Netherlands, Apr 4-5)
'Photodesorption of Interstellar CO ice Analogs'
Molecules in Space and the Laboratory (Paris, France, May 14-18)
'Photodesorption of Ices'
HRSMC Symposium (Amsterdam, Netherlands, Nov 22)
'Photodesorption of Interstellar Ice analogs'

Ödman
ESO IYA meeting (Garching, Germany; Mar 2–4)
'The Universe Awareness Programme'
'Report on the Lunar Eclipse Skypecast'
Meeting of the Royal Astronomical Society (London, UK; Mar 9)
'The Universe Awareness Programme'
Planetarium through ages: Vision 2027 (Mumbai, India; Mar 19-20)
'Universe Awareness for Young Children'
Universe Awareness Tamil Nadu Science Forum workshop (Chennai, India; Mar 25–27)
'The Universe Awareness Programme'
'The International Experience of UNAWE'
National Astronomy Meeting (Preston, UK; Apr 15–18)
'Universe Awareness in the UK: all about opportunities'
Chair of one of the two the Education and Outreach sessions
National Science Week (Cape Town, South Africa; May 12–19)
'Universe Awareness: Inspiring young children'
Building the Scientific Mind (Vancouver, Canada; May 28 – June 31)
'Inspiring Young Children with the beautiful universe'
Essential Contact (Granada, Spain; June 30 – July 2)
'Essential Contact - Hall of the Universe: some ideas'
International Astronautical Congress (Hyderabad, India; Sep 24–28)
'The Universe Awareness Programme'
Forum on Space and Civil Society (Vienna, Austria; Oct 8–9)
Communicating Astronomy to the Public 2007 (Athens, Greece; Oct 10–11)
'Universe Awareness Internationally' (poster)

Oliveira
From Stars to Planets (Gainesville, USA; April 11-14)
'Protoplanetary Disk Evolution in Serpens'

Omar
Astrophysics in the LOFAR Era (Emmen, The Netherlands; Apr 23-27)
HI Survival Through Cosmic Times (Sarteano, Italy; June 11-15)
'HI survival in a group environment'

Oonk
Tracing Cosmic Evolution with Clusters of Galaxies: Six Years later (Sesto (BZ) Alto Adige, Italy; Jun 24-30)

Paardekooper
First Stars Workshop (Copenhagen, Denmark; Apr 16-20)
'*First Light in the Primordial Gas: Radiation Hydrodynamics of the First Stars*'
New Trends in Radiation Hydrodynamics (Stockholm, Sweden; May 9-11)
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
'*First Light in the Primordial Gas: Radiation Hydrodynamics of the First Stars*'
First Stars III (Santa Fe, New Mexico, USA; July 16-20)
'*First Light in the Primordial Gas: Radiation Hydrodynamics of the First Stars*'
Radiative transfer workshop (Durham, UK; Sep 3-7)
'*Triangulating Radiation: SimpleX Radiative Transfer*'
Adaptive-mesh simulations with FLASH (Bremen, Germany; Oct 15-18)
'*Triangulating Radiation: SimpleX Radiative Transfer*'

Pandey-Pommier
LOFAR- CS1 meetings (weekly meeting, ASTRON, Dwingeloo, Netherlands)
Young LOFAR meeting (Amsterdam, Netherlands; Nov 26**)**
LOFAR survey workshop (Leiden, Netherlands; Dec 12-15)

Panic
Marie Curie Research Training Network (MOLECULAR UNIVERSE), 2nd year and Mid-Term Review Meeting (Perugia, Italy; 19-21 March 2007)
'High resolution molecular line observations of circumstellar disks'
Dutch ISM/CSM Meeting (Amsterdam, Netherlands; Apr 21)
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
Transformational Science with ALMA: from Disks to Stars and Planets (Charlottesville, Virginia, USA; June 22-24)
'Molecular Gas and Dust Content of the Disk around HD169142'

Pawlik
Computational Cosmology (Leiden, Netherlands; Jan 15-19
'Radiative Transfer in GADGET'
New Trends in Radiation Hydrodynamics (Stockholm, Sweden; May 9-11)
'Cosmological Radiative Transfer in GADGET'
11th Paris Cosmology Colloqium (Paris, France; Aug 16-18)
Radiative Transfer Workshop (Durham, England; Sep 3-7)
'Radiative Transfer in Smoothed Particle Hydrodynamics'

Prod'homme
NOVA Fall School (Dwingeloo, Netherlands; Oct 8-12)
ELSA school on the science of Gaia (Leiden, Netherlands; Nov 19-28)

Raban
Obscured AGNs across cosmic time (Seeon, Germany, Jun 5-8)
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
VLTI school (Torun, Poland; Aug 26 – Sep 7)

Rakic
Computational Cosmology (Leiden, Netherlands; Jan 15-19)
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
HI Survival through Cosmic Times (Siena, Italy; June 11-15)
'Observations of HI near Lyman Break Galaxies'
Galaxy Growth in a Dark Universe (Heidelberg, Germany; Jul 16-20)
'Observations of HI and CIV near Lyman Break Galaxies'
Next Generation of Computational Models of Baryonic Physics in Galaxy Formation (Zürich, Switzerland; Sep 17-21)

Rampadarath
NOVA Fall School (Dwingeloo, Netherlands; Oct 8-12)

Röttgering
Herschel Open Time Key Program Workshop (ESTEC, Noordwijk, Netherlands; Feb 20-21)

Extragalactic surveys with LOFAR (Lorentz Center, Leiden, Netherlands; Mar 6-8
'Current survey plans and main goals'
International MeerKAT Meeting (Amsterdam, Netherlands; Apr 20-21)
'The use of MeerKAT for continuum surveys'
Astrophysics in the LOFAR era (Emmen, Netherlands; Apr 23-27)
'Survey Key Science Project Plans'
AAS meeting: Wide-Field Surveys in the 21st Century (Honolulu, Hawaii; May 26 - June 2)
'Wide field surveys with LOFAR'
SKADS Meeting (Jodrell Bank, Manchester, UK; June 6)
'Ionosphere Calibration'
XMM-LSS survey consortium meeting (Universite' de Luminy, Marseille, France; June 14-15)
'LOFAR - Opening up a New Window on the Universe'
SKADS meeting (Institute d'Astrophysique, Paris, France; Oct 9)
'SKA and ionospheric calibration'
Darwin science team meeting (Institut d'Astrophysique Spatiale (IAS), Paris, France; Dec 6-7)
'Astrophysical Imaging with Darwin - Next steps'
'NL/European technical projects related to Darwin'
The prospects of LOFAR surveys (Lorentz center, Leiden, Netherlands: Dec 10-12)
'Survey project'

Salter
eSMA Workshop (Leiden, Netherlands; Feb 1-2)
From Stars to Planets: Connecting Our Understanding of Star and Planet Formation (Gainesville, Florida; Apr 11-14)
'Microgravity Experiments Probing Collision Processes in the Solar Nebula'
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
'Microgravity Experiments Probing Collision Processes in the Solar Nebula'
VLTI Summer School (Porto, Portugal; May 27 - Jun 8)
'Microgravity Experiments Probing Collision Processes in the Solar Nebula'
NOVA Fall School (Dwingeloo, Netherlands; Oct 8-12)

Schaye
Computational Cosmology (Leiden, Netherlands; Jan 15- 19)
'The OverWhelmingly Large Simulations project'
EDGE workshop (Utrecht, Netherlands; Mar 19-21)
HI Survival through Cosmic Times (Spineto, Italy; Jun 11-15)
'Does nearly all of the intergalactic HI reside in metal-free gas?' (invited talk)
'Star formation thresholds and the HI-H_2 transition' (invited talk)
Dark Galaxies & Lost Baryons (Cardiff, UK; Jun 25-29)
'Star Formation Thresholds and Kennicutt-Schmidt laws' (invited review)
Gas Accretion and Star Formation in Galaxies (Garching, Germany; Sep 10-14)
'How Feedback Influences the IGM and its Metals' (invited talk)
Next generation of computational models of baryonic physics in galaxy formation: from protostellar cores to disk galaxies (Zürich, Switzerland; Sep 17-21)
'First Results from OWLS: the OverWhelmingly Large Simulations Project'
Virgo collaboration meeting (Durham, UK; Dec 17-19)
'The OverWhelmingly Large Simulations project'

Smit
Outstanding Questions for the Standard Cosmological Model (London, UK; March 26-29)
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
DUEL Kick-off Meeting (Edinburgh, UK; Oct 8-9)

Snellen
Approaching Micro-Arcsecond Resolution with VSOP-2: Astrophysics and Technology (Conference Hall at ISAS/JAXA, Sagamihara, Kanagawa, Japan; Dec 3-7)
'GPS and CSS sources and space VLBI' (title talk)

Soto
IAU 245: Formation and Evolution of Galaxy Bulges (Oxford, UK; July 16-20)
'3-Dimensional Kinematics in Low Foreground Extinction Windows of the Galactic Bulge'

Stuik
OSA Topical Meeting on Adaptive Optics (Vancouver, Canada; June 18-20)
'Integrated Testing of the ESO AO Facility: The Development of ASSIST'
SPIE Conference on Optics and Photonics (San Diego, USA; Aug 26-30)
'ASSIST: development of a test-infrastructure for the VLT AO facility'

Taylor
IAU Symposium 244: Dark Galaxies and Lost Baryons (Cardiff, UK; June 25-29)
'Dark Galaxies: the interface between galaxy- and star-formation'
Galaxy Growth in a Dark Universe (Heidelberg, Germany; July 16-20)
'The Emergence of the Red Galaxy Sequence' (Poster)
Panoramic Views of Galaxy Formation and Evolution (Hayama, Japan; Dec 11-15)
'Massive Galaxy Formation and the Rise of the Red Sequence'

Torstensson
ESTRELA Workshop (Dwingeloo, Netherlands; Jan 15-18)
'Methanol masers - tracers of massive star formation'
eSMA Workshop (Leiden, Netherlands; Feb 1-2)
IAU Symposium 242 (Alice Springs, Australia; March 12-16)
'Where methanol masers spring'
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
'Where methanol masers spring'
Young European Radio Astronomer's Conference (YERAC) (Bordeaux, France; Sept 4-7)
'Methanol masers - tracing high-mass star-formation'
Massive Star Formation: Observations confront Theory (Heidelberg, Germany; Sept 10-14)
'Where methanol masers spring'
ESTRELA Workshop (Manchester, UK; Oct 8-11)
'Methanol masers - tracing high-mass star-formation'
Bonn-Dwingeloo High Resolution Radio Astronomy meeting (Dwingeloo, Netherlands; Oct 30)
'Where methanol masers spring'

Usov
Astron meeting (Dwingeloo, Netherlands, weekly)

van Bemmel
Young LOFAR day (Groningen, Netherlands, Feb 22)
LOFAR Surveys (Leiden, Netherlands, Mar 6-8)
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands, May 14-16) (Chair of LOC)
Modern Radio Universe 2007 (Manchester, UK, Oct 1-4)
'Ionospheric limitations for LOFAR and SKA'
LIONS kick-off (Dwingeloo, Netherlands; Oct 10)
LOFAR Calibration workshop (Dwingeloo, Netherlands; Oct 16-18)
LIONS: LOFAR IONospheric Simulations'
LOFAR Surveys (Leiden, Netherlands, Dec 10-12)
'LIONS: LOFAR IONospheric Simulations (update)'
LIONS long baseline meeting (Leiden, Netherlands; Dec 13)
'LIONS: LOFAR IONospheric Simulations (update)'

van Delft
Science and World War II (Museum Boerhaave, Leiden, Netherlands, Jan 25-26)
Show Physics (Lorentz Center, Leiden, Netherlands, Mar 26-30)
XXVI Scientific Instrument Commission Symposium (Cambridge, USA; Sep 6-11)

van der Werf
Extragalactic surveys with LOFAR (Leiden, The Netherlands; Mar 6-8)
'LOFAR and high-redshift starburst galaxies'
The Origin of Galaxies: Exploring Galaxy Evolution with the New Generation of Infrared-Millimetre Facilities (Obergurgl, Austria; Mar 24-29)
'Legacy Surveys with SCUBA-2'
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
Legacy of multi-wavelength surveys (Xining, China; Aug 19-25)
'The SCUBA-2 Cosmology Legacy Survey
ALMA Community meeting (Garching, Germany; Sep 3-4)
'The James Clerk Maxwell Telescope'
Surveys for ALMA (Garching, Germany; Sep 5-6)

van Dishoeck
A science vision for European astronomy (Poitiers, France; Jan 22-24)
Science with the eSMA (Leiden, Netherlands; Feb 1-2)
'Introduction into eSMA science' (invited review)
From stars to planets (Gainesville, USA; Apr 11-14)
'Chemistry in evolving protoplanetary disks' (invited talk)
Molecules in space and the laboratory (Paris, France; May 14-18)
'New instruments for new insight' (invited review)
Canadian astronomical society meeting (Kingston, Canada; June 5-7)
'Spitzer observations of star- and planet-forming regions: from ice cold to steaming hot' (Petrie award lecture)
NOCA science day (Utrecht, Netherlands; Aug 27)
'Future of the NOVA Network program'
Astrophysics in the next decade: JWST and concurrent facilities (Tucson, USA; Sep 24-28)
'Astrochemistry of dense protostellar environments' (invited review)
From cores to disks: Spitzer-IRS meeting (Pasadena, USA; Sep 29 - Oct 2)
SOFIA 2020 vision workshop (Pasadena, USA; Dec 6-7)
'SOFIA science opportunities to 2020' (invited review)

van Haasteren
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
NOVA Fall School (Dwingeloo, Netherlands, Oct 8-12)

van Kempen
Herschel Open Time Key Projects (Noordwijk, Netherlands Feb 22-25)

van Langevelde
eSMA workshop (Leiden, Netherlands; Feb 1-2)
EVN2015 workshop (Dwingeloo, Netherlands; Feb 28 - Mrt2)
24th Asia-Pacific Network Meeting (Xi'An, China; Aug 25-30)
'e-VLBI a real-time telescope of intercontinental dimensions'
Massive Star Formation; Observations confront theory (Heidelberg, Germany; Sep 10-14)
European Radio Interferometry School (Bonn, Germany; Sep 12-13)
'The Atacama Large Millimeter Array (ALMA)'
e-VLBI symposium (Bonn, Germany; Sep 17-18)
Modern Radio Universe (Manchester, UK; Oct 1-5)

van Weeren
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands, May 14-16)
'Chemical Evolution of a Collapsing Prestellar Core'
X-shooter GTO meeting (Nijmegen, Netherlands, Nov 7)
'LOFAR sources with extreme spectra and the quest for galaxies at z > 6'
MCCT-SKADS Training School (Bologna, Italy, Sep 23-29)
Vermaas
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
The evolving ISM in the Milky Way and nearby galaxies (Pasadena, USA; Dec 2-5)
'The nuclear starburst of M83 revealed with SINFONI' (poster)

Visser
Dust, Gas and Chemistry in Space (Belfast, UK; Jan 4-5)
'PAH chemistry and IR emission from circumstellar disks'
Spitzer c2d/IRS team meeting (Leiden, the Netherlands; Mar 12-16)
ISM/CSM Meeting (Amsterdam, the Netherlands; Apr 5)
'PAH chemistry and IR emission from circumstellar disks'
Molecules in Space and Laboratory (Paris, France; May 14-18)
'PAH chemistry and IR emission from circumstellar disks'

Wehres
Chemische Wetenschappen, Spectroscopy and Theory (Lunteren, Netherlands; Jan 29-30)
'High Resolution Spectroscopy of Molecular Transients of Astrophysical Interest'
Marie Curie FP6 Network Meeting and Midterm Review (Perugia, Italy; March 19-22)
'The Molecular Universe'
Molecules in Space and Laboratory (Paris, France; May 13-18)
High Resolution Spectroscopy of Molecular Transients of Astrophysical Interest
Joined Marie Curie FP6/IRAM Observing Summer School 2007 (Pradollano, Spain; Sep 28 – Oct 05)

Weijmans
SAURON team meeting (Groningen, Netherlands; Jan 17-19)

Nederlandse Astronomen Conferentie (Veldhoven, Netherlands; May 14-16)
'Cold and hot gas in NGC 2974: from 100 pc to 10 kpc scales'
'Getting high school students into astronomy: the first Dutch Astronomy Olympiad'
Summer School on Formation and Evolution of Galaxy Bulges (Oxford, UK; July 12-13)
SAURON team meeting (Oxford, UK; July 23-25)
ATLAS3D team meeting (Oxford, UK; July 25-27)
SAURON team meeting (Leiden, Netherlands; Dec 10-13)

Wiersma
Computational Cosmology (Leiden, Netherlands; Jan 15-19)
Nederlandse Astronomen Conferentie (Veldhoven, Netherlands, May 14-16)
Galaxy growth in a dark Universe (Heidelberg, Germany, July 16-20)
'Chemodynamics in Cosmological Simulations: Where are the metals?'

Williams
Galaxy Growth in a Dark Universe (Heidelberg, Germany; Jul 16-20)
'Warm-Hot Absorbers at z=0: Galactic or extragalactic?'

Appendix

VII

Observing sessions abroad

Observing sessions abroad

Appendix VII

Albrecht
TNG (La Palma, Spain; July 27-03)

Bast
VLT-CRIRES (Paranal, Chile; Aug 29 - Sep 6)

Bottinelli
Green Bank Telescope (Green Bank, West Virginia, USA; Dec 26 2006-Jan 9)
Institut de RadioAstronomie MillimŽtrique 30 m Telescope (Pico Veleta, Spain; Mar 27-Apr 3)
James Clerk Maxwell Telescope / expanded SubMillimeter Array (Mauna Kea, Hawai`i, USA; May 29-Jun 1)
James Clerk Maxwell Telescope / expanded SubMillimeter Array (Mauna Kea, Hawai`i, USA; Aug 27-Sep 1)
Institut de RadioAstronomie Millimétrique 30 m Telescope (Pico Veleta, Spain; Nov 13-20)
Institut de RadioAstronomie Millimétrique 30 m Telescope (Pico Veleta, Spain; Dec 15-21)

de Mooij
Observatorio del Teide, Telescopio Carloz Sanchez (Tenerife, Spain; Dec 14-22)

Franx
Keck Observatory (Mona Kea, Hawaii, USA; Jan 9-13)

Hatch
William Herschel Telescope (La Palma, Spain; Dec 28-30)

Hill
Submillimetre Array (SMA) (Hilo, Hawaii; Apr 1-9)
Paul Wild Observatory Mopra Telescope (Narrabri, Australia; Aug 13-20)
APEX telescope (San Pedro, Chile; Oct 15-24)

Jaffe
Cerro Paranal (Paranal, Chile; June 21-30)
Cerro Paranal (Paranal, Chile; Nov 13-27)

Kuijken
William Herschel Telescope (La Palma, Spain; Feb 12-20)

Lommen
Submillimeter Array (Mauna Kea, HI, USA; July 14-22)

Miley
Australian Telescope (Narrabri, Australia; Sep 10–14)

Oliveira
WHT (La Palma, Spain; June 9-11)
VLT/ESO (Paranal, Chile; Oct 10-18)

Omar
Giant Meterwave Radio Telescope (Pune, India; Mar 01-17)
Giant Meterwave Radio Telescope (Pune, India; July 17-29)

Pandey-Pommier
Giant Metrewave Radio Telescope (Pune, India, Aug 15 – sep 4)

Raban
Paranal VLTI 8m (Paranal, Chile, Feb 6-7)
Paranal VLTI 8m (Paranal, Chile, Apr 16-17)
Paranal VLTI 1.8m (Paranal, Chile, Oct 6-7)

Salter
JCMT (Mauna Kea, Hawaii, USA; Nov 1-8)

Snellen
Isaac Newton Telescope, Isaac Newton Group (La Palma, Spain; May 4-9)

Torstensson
JCMT (Hilo, Hawaii, USA; Jun 15-18)

van der Werf
ESO (Paranal, Chile; Dec 30-31)

van Dishoeck
VLT-CRIRES (Paranal, Chile; April 21-28)
APEX (San Pedro, Chile; June 21-25)
APEX (San Pedro, Chile; November 1-4)

van Kempen
James Clerk Maxwell Telescope (Mauna Kea, Hawaii; Feb 3–9)
APEX (San Pedro de Atacama, Chile; June 14 - July 3)
James Clerk Maxwell Telescope (Mauna Kea, Hawaii; July 3–11)
APEX (San Pedro de Atacama, Chile; Oct 21 - Nov 6)

van Weeren
GMRT (Pune, India, Jul 17-25)

Vermaas
VLT (Paranal, Chile; Dec 29-30)

Wehres
IRAM Observatory (Pradollano, Spain; Sep 28 – Oct 5)

Weijmans
3.5m Telescope (Calar Alto, Spain; Jan 21-23)

Williams
William Herschel 4.2 m Telescope (La Palma, Spain; Nov 7-11)

Appendix

VIII

Working visits abroad

Working visits abroad

Appendix VIII

Albrecht
MPIA (Heidelberg, Germany; Mar 13-17)
MPIA (Heidelberg, Germany; Dec 16-19)

Alexander
Institute of Astronomy, University of Cambridge (Cambridge, UK, Nov 12-17)

Amiri
Bonn University (Bonn, Germany, Dec 12-14)

Bast
Caltech (Pasadena, USA; Sep 15 - Oct 6)

Bottinelli
Observatoire de Bordeaux (Bordeaux, France; Feb 7-11)
Center for Astrophysics (Cambridge, Massachusetts, USA; Aug 20-24)
IPAC/Caltech (Pasadena, California, USA; Oct 3-10)
Center for Astrophysics (Cambridge, Massachusetts, USA; Oct 15-24)
Observatoire de Bordeaux (Bordeaux, France; Dec 8-14)

Bouwman
University College Cork (Cork, Ireland, Apr 15-20)

Brandl
MIRI European Consortium Meeting (Toulouse, France; Mar 13-16)
Cornell University (Ithaca, USA; May 2-13)
JWST Partner Workshop (Dublin, Ireland; June 11-13)
ELT Design Study mid-term review (Garching, Germany; June 13-14)

GranteCan Instrument PDR (Review), (Mexico City, Mexico; June 30 - July 5)
MIRI European Consortium Meeting (Heidelberg, Germany; Oct 24 - 26)

Brown
Osservatorio Astronomico di Roma (Monte Porzio, Italy; Jan 18-19)

Cuppen
Aarhus University (Aarhus, Denmark; Ma 14-16)
Cologne University (Cologne, Germany; May 8-9)

Dalla Vecchia
MPA (Garching, Germany; Mar 26-30)

Damen
Department of Astronomy, Yale University (New Haven, USA, Apr, 9-29)

Franx
University of California, Santa Cruz (Santa Cruz, USA, Jan 4-8)
ESO (Garching, Germany; Mar 13-14)
Yale University (New Haven, USA; Apr 14-18)
Harvard-Smithsonian Center for Astrophysics (Cambridge, USA; Apr 18-19)
University of California, Santa Cruz (Santa Cruz, USA, June 28-30)
Harvard-Smithsonian Center for Astrophysics (Cambridge, USA; July 27-Aug 19)
Yale University(New Haven, USA; Nov 11-15)
Harvard-Smithsonian Center for Astrophysics (Cambridge, USA; Nov 16-17)
MPIA (Heidelberg, Germany; Dec 18-20)

Groves
MPE (Garching, Germany; Apr 1-4)

Hatch
Jila (Boulder, USA; Aug 1-17)
Institute of Astronomy (Cambridge, UK; Nov 12-16)

Hill
University of NSW (Sydney, Australia; Mar 3-10)
University of NSW (Sydney, Australia; Mar 18-31)
University of NSW (Sydney, Australia; Aug 7-12)
University of NSW (Sydney, Australia; Aug 21-31)
University of NSW (Sydney, Australia; Dec 3-21)

Hopman
Max-Planck Institut fuer Gravitationsphysik (Potsdam, Germany, June 6-8)
Weizmann Inst. of Science (Rehovot, Israel; July 20 - Aug 6)
IoA (Cambridge, UK, Nov 28 - Dec 2).

Intema
NRAO (Charlottesville, VA, USA; Feb 5-16)
NRAO (Charlottesville, VA, USA; July 4-12)

Ioppolo
Inaf - Osservatorio Astrofisico di Catania, Catania University (Catania, Italy; Apr 7-30)

Israel
ESO-OPC (Garching, Germany; May 22-24)
DPG EPN Board (Berlin, Germany; Oct 27)
ESO-OPC (Garching, Germany; Dec 20-22)

Jaffe
MPIA (Heidelberg, Germany; Feb 5-9)
Observatoire de Nice, (Nice, France; Feb 6-7)
MPIA (Heidelberg, Germany; March 12-13)
ESO (Garching Germany; April 2-4)
MPIfR (Bonn, Germany; April 4-6)
ESO (Garching, Germany; April 16-17)
Observatoire de Nice (Nice, France; April 23-24)
MPIA (heidelberg, Germany; Oct. 4-5)
Observatoire de Nice (Nice, France; Oct 16-17)
Observatoire de Nice, (Nice, France; Nov 16-17)
MPIA (Heidelberg, Germany; Nov 23-24)

Katgert
Osservatorio Astronomico (Trieste, Italy; Jul 4-14)

Kendrew
MIRI test team meeting (Didcot, UK; Apr 25-26)
MIRI EGSE training (Didcot, UK; June 11-13)
MIRI EC meeting (Heidelberg, Germany; Oct 24-26)
UK Astronomy Technology Centre (Edinburgh, UK; Nov 27)

Kuijken
University Observatory München (München, Germany; Jan 26-27)
Rutherford Appleton Laboratory (Didcot, UK; Oct 1-2)
ESO (Garching, Germany; Dec 4-5)
Basel Astronomy Institute (Basel, Switzerland; Dec 14)

Levin, (Sarah)
Frankfurt Book Fair (Frankfurt, Germany; Oct 13-14)

Linnartz
University College Cork (Cork, Ireland; February)
Physica Scripta / IOP board meeting (Bristol, UK; March)
FP7 ITN kick-off meeting UCL (London, UK; March)
CERN (Geneva, Zwitserland; June)
INP Greifswald (Greifswald, Germany; June)
Astronomical Institute University Leuven (Leuven, Belgium; regular)
Sackler Foundation (New York, USA; December)

Lommen
Institute for Astronomy (Manoa, HI, USA; July 24-25)
Swinburne University (Melbourne, Australia; Nov10-24)
UNSW@ADFA (Canberra, Australia; Nov 24 - Dec 4)

Lub
Akademie der Wissenschaften (Vienna, Austria; May 4 - 6)
Astronomy and Astrophysics Board

Maschietto
IoA Cambridge University (Cambridge, UK; Feb 10-16)

Micelotta
Institut d'Astrophysique de Paris (IAP) (Paris, France; Mar 1st - Nov 15)
Institut d'Astrophysique Spatiale (IAS) (Orsay, France; Mar 1st - Dec 16)

Miley
IAU EC, South African Astronomical Observatory (Cape Town, South Africa; May 15–18)
UNAWE ISC, South African Astronomical Observatory (Cape Town, South Africa; May 24–25)
UNAWE ISC, UNESCO (Paris, France; Sep 3)
ACS, Johns Hopkins University (Baltimore, USA; Sep 17–18)
CONGO, UNOOSA (Vienna, Austria; Octber 8–10)

UNAWE, DG Research, European Union (Brussels Belgium; Nov 20)
Istituto Radioastronomia (Bologna, Italy; Nov 25–29)
Max Planck Institute for Radio Astronomy (Bonn, Germany; Dec 17-19)

Ödman
UNESCO (Paris, France; Jan 6–9)
Consejo Superior de Investigaciones Cientificas (Madrid, Spain; Jan 25-26)
Institute for Computational Cosmology (Durham, UK; Mar 10-13)
Tamil Nadu Science Forum (Chennai, India; Mar 21–25)
Unizul Science Centre (Richard's Bay, South Africa; Apr 30)
Ministry of Education (Mbabane, Swaziland; May 2)
Catembe Science Centre (Catembe, Mozambique; May 3)
Ministry of Education (Maseru, Lesotho; May 8)
SAAO (Cape Town, South Africa; May 16–23)
Universe Awareness ISC Meeting (Cape Town, South Africa; May 24–25)
Herzberg Institute (Victoria, Canada; June 1-3)
Pratham Mumbai and Hyderabad offices (Hyderabad, India; Sep 29)

Oliveira
California Institute of Technology (Pasadena, USA; Mar 15 – Dec 31)

Röttgering
Max Planck Institut for Astronomy (Heidelberg, Germany; April 15-17)
Royal Observatory Edinburgh (Edinburgh, UK; June 12)

Salter
Strathclyde University (Glasgow, Scotland, UK; Mar 2-5)

Schaye
Institute of Astronomy (Edinburgh, UK; Oct 31 - Nov 1)

Snellen
Observatoire de Paris (Paris, France; Nov 26)

Stuik
ESO (Garching, Germany; Mar 21)
ESO (Garching, Germany; Jul 17)
ESO (Garching, Germany; Aug 9)
ESO (Garching, Germany; Oct 29-30)
Observatoire de Lyon (Lyon, France; Dec 17-20)

Taylor
MPIA (Heidelberg, Germany; Feb 26-Mar 9)

van der Werf
Centre National d'Etudes Spatiales (Toulouse, France; Mar 13)
Observatoire de Geneve (Geneva, Switzerland; Mar 15-16)
Queen's University (Belfast, Northern Ireland, UK; May 24-25)
European Southern Observatory (Garching, Germany; Oct 19)
Joint Astronomy Center (Hilo, Hawii, USA; Nov 26-27)

van Dishoeck
Max Planck Institut für Extraterrestrische Physik (Garching, Germany; Mar 1-3)
CNES (Toulouse, France; Mar 13-14)
National Astronomical Observatory of Japan (Tokyo, Japan; Mar 27)
Annual Reviews (Palo Alto, USA; Apr 15)
IPAC (Pasadena, USA; Apr 16-20)
Max Planck Institut für Extraterrestrische Physik (Garching, Germany; May 7-8)
University of Chicago (Chicago, USA; June 8)
IAS (Dublin, Ierland; June 11-12)
ALMA offices (Santiago, Chile; June 26-29)
Max Planck Institut für Extraterrestrische Physik (Garching, Germany; Aug 6-19)
Center for Astrophysics (Cambridge, USA; Sep 4-5)
Max Planck Institut für Extraterrestrische Physik (Garching, Germany; Sep 20-21)
California Institute of Technology (Pasadena, USA; Sep 29-Oct 2)
Max Planck Institut für Extraterrestrische Physik (Garching, Germany; Oct 6-7)
Max Planck Institut für Astronomie (Heidelberg; Oct 8-9)
Max Planck Institut für Extraterrestrische Physik (Garching, Germany; Oct 17-22)
Max Planck Institut für Astronomie (Heidelberg; Oct 24-25)
ALMA offices (San Pedro, Chile; Oct 29-31)
Max Planck Institut für Extraterrestrische Physik (Garching, Germany; Nov 15-19)
University of Durham (Durham, UK; Nov 21)
California Institute of Technology (Pasadena, USA; Dec 5-7)
Osservatorio Arcetri (Florence, Italy; Dec 13-14)

van Kempen
MPE (Garching, Germany; Dec 17-24)

van Langevelde
Shanghai Observatory (Shanghai, China; Aug 22-25)

Visser
MPIA (Heidelberg, Germany; Nov 9-16)
MPE (Garching, Germany; Dec 17-21)

Wehres
Institute of Astronomy (Leuven, Belgium; Feb 20)
Institute of Astronomy (Leuven, Belgium; Sep 05)
Institute of Astronomy (Leuven, Belgium; Sep 26)
Institute of Astronomy (Leuven, Belgium; Nov 21)

Weijmans
Observatoire de Lyon (Lyon, France; Mar 12-16)
University of Oxford (Oxford, UK; July 16-20)
University of Durham (Durham, UK; Nov 6-9)
ESO (Garching, Germany; Nov 19-23)

Wuyts
Harvard-Smithsonian Center for Astrophysics (Cambridge, USA; Apr 15 - May 5)

Williams
Yale University (New Haven, CT, USA; Apr 30 - May 24)

Appendix

IX

Colloquia given outside Leiden

Colloquia given outside Leiden

Appendix IX

Alexander
Formation & Dynamics of the Galactic Centre Stellar Discs
University of Leicester, Leicester, UK, Dec 12

Bast
SiS line emission as a probe of chemistry and grain formation in circumstellar envelopes of AGB stars
Universidad Nacional de Colombia, Bogota, Colombia; Aug 21

Bottinelli
Hot corinos: pre-biotic molecules around solar-type protostars
Observatoire de Bordeaux, Bordeaux, France; Feb 8
Idem
Center for Astrophysics, Cambridge, Massachusetts, USA; Aug 24
Idem
Joint Astronomy Center, Hilo, Hawai`i, USA; Aug 27

Brandl
Starburst Studies with Spitzer
Max Planck Institut fuer Radiastronomie, Bonn, Germany; Feb 2
Idem
University of Virginia, Charlottesville, USA; April 30
Idem
Cornell University, Ithaca, USA; May 9

Brown
Gaia - taking the Galactic census
Osservatorio Astronomico di Roma, Monte Porzio, Italy; Jan 18

Idem
Sterrenkundig Instituut, Utrecht, Netherlands; Feb 7

Cuppen
Monte Carlo Simulations of Interstellar Surface Chemistry
Aarhus University, Aarhus, Denmark; Mar 14
Idem
Cologne University,Cologne, Germany; May 8
Idem
Universiteit Groningen, Groningen, Netherlands; Oct 30

Hatch
Diffuse UV light in the Spiderweb: Evidence for star formation outside galaxies
Jila, Boulder, USA; Aug 17

Hill
Profiling Young Massive Stars University of New South Wales
Kensington, Australia; Mar 7
Idem
Submillimetre Array, Hilo, Hawaii; Apr 2
Idem
SRON, Groningen, Netherlands; Sept 17
Idem
JIVE, Dwingeloo, Netherlands; Sept 20
'Examining the Evolutionary Sequence of Massive Star Formation'
University of Exeter, Exeter, UK; Oct 4

Hopman
Stellar dynamics near massive black holes
Max-Planck Institut für Gravitationsphysik, Potsdam, Germany, June 7

Intema
Large-scale structure of Lyman break galaxies around a radio galaxy protocluster at redshift z ~ 4
NRAO, Charlottesville VA, USA; Feb 13

Kendrew
MIDIR: A mid-infrared instrument for the E-ELT
University College London, London, UK; Nov 26

Kuijken
The KiDS Survey
Astronomy Dept., Nijmegen, Netherlands; Jun 13

Levin, (Sarah)
UNAWE: Humanizing Astronomy
National Observatory of Athens, Greece; Oct 9

Linnartz
General physics colloquium
University of Cork, Ireland; February
Plasma and Surface Science in Molecular Astrophysics
FOM Institute for Plasma Physics (Nieuwegein, Netherlands; Nov 29)

Lommen
The first steps in Planet Formation: finding pebbles in southern protoplanetary disks
IfA, Manoa, HI, USA; July 25
Multi-wavelength observations of grain growth in protoplanetary disks
Swinburne University, Melbourne, Australia; Nov 13
Idem
UNSW@ADFA, Canberra, Australia; Dec 4

Micelotta
A Spitzer Study of the Supernova Remnant N157B Environment
Institut d'Astrophysique Spatiale (IAS) Orsay, France; Apr 20
A Supernova in a Star Forming Region: N157B in the LMC
Institut d'Astrophysique de Paris (IAP) Paris, France; June 28

Miley
Probing the Early Universe with Radio Galaxies
Limerick University, Limerick, Ireland, Feb 27
Idem
Dublin City University, Ireland, March 1
Idem
University College Cork, Ireland, March 5
Idem
Institute for Mathematics, Chennai, India, March 28
Idem
KNAW, Netherlands, Sep 24

Ödman
The Universe Awareness Programme – UK possibilities
(Durham, UK; Mar 13)
Universe Awareness: Sparking young children's curiosity
(SAAO, Cape Town, South Africa; May 23)

Oliveira
Disk Evolution in Serpens
Caltech, Pasadena, USA; Oct 1

Raban
The obscuring torus in NGC 1068
Tel Aviv University, Tel Aviv, Israel; May 26

Röttgering
LOFAR - Opening up a New Window on the Universe
Max Planck Institute for Astronomy, Heidelberg, Germany; Feb 6
Idem
Istituto di Radioastronomia, Bologna, Italy; Oct 15

Schaye
The Chemical Enrichment of the Intergalactic Medium
Edinburgh, U.K.; Oct 31

Schnitzeler
WSRT Faraday tomography of the Galactic ISM
University of Calgary, Calgary, Canada; Apr 15
Idem
Herzberg Institute of Astrophysics, Penticton, Canada; Apr 19

Vlahakis
Dust in Nearby Galaxies
Universiteit Gent, Belgium; Nov 30

van Dishoeck
Spitzer Observations of Gas and Dust in Star- and Planet-forming Regions: Ice Cold and Steaming Hot
Munich Joint Colloquium, Garching, Germany; Mar 1
Idem
National Astronomical Observatory of Japan, Tokyo, Japan; Mar 27
Idem
Astronomy Department, University of Chicago, Chicago, USA; June 8

Idem
APEX, San Pedro, Chile; June 24
Building planets and the ingredients of life between the stars: Grubb Parson prize lecture
Physics and Astronomy Department, Durham, UK; Nov 21
Spitzer Observations of Gas and Dust in Star- and Planet-forming Regions: Ice Cold and Steaming Hot
Physics and Astronomy Department, Durham, UK; Nov 21

van Langevelde
JIVE: progress with e-VLBI and science highlights
Shanghai, China; Aug 24

van Weeren
LOFAR: sky models and CS1 images
NCRA, Pune, India, Jul 24

Wuyts
Red galaxies at z~2.5: confronting simulations with observations
MPIA, Heidelberg, Germany; Jan 11

Appendix

X

Scientific publications

Sterrewacht Leiden

Scientific publications

Appendix X

X.1. Ph.D. Theses and Books

S. E. Bisschop, Complex Molecules in the Laboratory and Star Forming Regions, Ph.D. thesis, Leiden University, November 2007.

V. C. Geers, Polycyclic Aromatic Hydrocarbons in Disks around Young Solar-type Stars, Ph.D. thesis, Leiden University, October 2007.

S. Hekker, Radial velocity variations in Red Giant Stars: Pulsations, spots and planets, Ph.D. thesis, Leiden University, September 2007.

M. T. Kriek, The many phases of massive galaxies. A Near-Infrared spectroscopic study of galaxies in the early universe, Ph.D. thesis, Leiden University, September 2007.

F. Lahuis, Molecular fingerprints of star formation throughout the Universe: a space-based infrared study, Ph.D. thesis, Leiden University, May 2007.

N. G. H. Ritzerveld, The Simplicity of Transport. Triangulating the First Light, Ph.D. thesis, Leiden University, February 2007.

L. Snijders, Extreme star formation in starburst galaxies, Ph.D. thesis, Leiden University, November 2007.

D. van Delft, Freezing Physics; Heike Kamerlingh Onnes and the Quest for Cold (Edita, Amsterdam 2007).

S. E. R. Wuyts, Red Galaxies at High Redshift, Ph.D. thesis, Leiden University, September 2007.

X.2. Articles in Refereed Journals

K. Acharyya, **G. W. Fuchs**, H. J. Fraser, **E. F. van Dishoeck**, and **H. Linnartz**, Desorption of CO and O2 interstellar ice analogs, *Astron. Astrophys.* **466**, 1005–1012.

A. Al-Halabi and **E. F. van Dishoeck**, Hydrogen adsorption and diffusion on amorphous solid water ice, *Monthly Notices Roy. Astr. Soc.* **382**, 1648–1656.

S. Albrecht, S. Reffert, **I. Snellen**, **A. Quirrenbach**, and D. S. Mitchell, The spin axes orbital alignment of both stars within the eclipsing binary system V1143 Cyg using the Rossiter-McLaughlin effect, *Astron. Astrophys.* **474**, 565–573.

L. Armus, V. Charmandaris, J. Bernard-Salas, H. W. W. Spoon, J. A. Marshall, S. J. U. Higdon, V. Desai, H. I. Teplitz, L. Hao, D. Devost, **B. R. Brandl**, Y. Wu, G. C. Sloan, B. T. Soifer, J. R. Houck, and T. L. Herter, Observations of Ultraluminous Infrared Galaxies with the Infrared Spectrograph on the Spitzer Space Telescope. II. The IRAS Bright Galaxy Sample, *Astrophys. J.* **656**, 148–167.

O. Asvany, E. Hugo, F. Müller, F. Kühnemann, S. Schiller, J. Tennyson, and S. Schlemmer, Overtone spectroscopy of H2D+ and D2H+ using laser induced reactions, *J. of Chem. Phys.* **127**, 154317-154318.

L. Bai, D. Marcillac, G. H. Rieke, M. J. Rieke, **K.-V. H. Tran**, J. L. Hinz, G. Rudnick, D. M. Kelly, and M. Blaylock, IR Observations of MS 1054-03: Star Formation and Its Evolution in Rich Galaxy Clusters, *Astrophys. J.* **664**, 181–197.

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