Research Institute Leiden Observatory

(Onderzoekinstituut Sterrewacht Leiden)

Annual Report 2006

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Cover: Images of LMC-N11:
ionized carbon (front cover) and optical (back cover)

N11 is the second major star-forming region in the Large Magellanic Cloud. Optical images show ionized gas (red H-alpha light) and the blue OB stars ionizing them. Particularly notable is the shell of gas around the rich LH 9 OB star association.

The northeastern quadrant of the shell around LH 9 can easily be recognized in a KAO image showing the distribution of ionized carbon ([CII]). The ultraviolet light from LH 9 causes CO in the molecular clouds along the shell to break up into oxygen and carbon, which is then ionized by the UV radiation. The image thus shows the erosion of the starforming clouds, putting an end to the process. The region depicted here is one of the first targets for five-times sharper imaging by ESA's Herschel space telescope, to be launched in 2008.

An electronic version of this annual report is available on the web at
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Production Annual Report 2006:
M. Franx, C. Gündisch, J. Lub, E. Scherpenzeel

Sterrewacht Leiden

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Review of major events

Chapter 1

This booklet describes the main events of 2006 at Sterrewacht Leiden. Our department of about 20 permanent scientific staff, 30 postdoctoral fellows, 40 PhD students and 10 support staff together remain focussed on teaching, research and outreach in astronomy.

As demonstrated below, the scientific productivity in 2006 was high, with around 300 scientific publications involving sterrewacht members, 15 conferences, symposia and workshops organized in Leiden, and a steady stream of visitors and colloquium speakers. The institute continues to score very well in international competitions for observing time at space observatories and on the ground, as well as for research grants. The department continues to attract a steady stream of students for the BSc and MSc degrees, and into the PhD programme.

There were many highlights in 2006.

In September a one-day symposium took place to honour Ingrid van Houten, who turned 85. Ingrid has been associated with the institute for nearly 50 years, hunting asteroids on photographic plates in the Palomar-Green survey. Many old friends from around the world came to make it a special day, and heard Brian Marsden (Harvard/Smithsonian) give a special colloquium dedicated to her work.

Another eminent Sterrewachter, Adriaan Blaauw, had his portrait painted by Teun Roebroek, and the beautiful painting now hangs in a prominent place in the Oort room.

A vibrant colloquium programme, run by Joop Schaye and Yuri Levin, continued to bring a series of excellent astronomers to Leiden. The year's Oort professor was Roger Blandford (Stanford), and he helped organize a lively workshop on gravitational lensing at the Lorentz Center (14 more LC astronomy workshops took place throughout the year). In december Chuck Steidel (Pasadena) delivered the Sackler lecture and spent a week among us.

Many students become involved in observational programmes, and this may require travel to distant places. This year this custom was taken to a new extreme by several of our MSc students --- the ICES team --- who flew in the ESA parabolic flight programme to perform microgravity experiments. They returned 'shaken, not stirred', and who knows, maybe there will be another episode in '0(0)7'...

The summer saw, among many other conferences, the triannual General Assembly of the International Astronomical Union (of which George Miley was elected one of the Vice-Presidents), in Prague. Many Sterrewachters attended, losing a planet along the way! Subsequently we lost many students as well, after a marathon session at the end of August during which six people received their MSc in astronomy. Office space remains tight, though.

Successful grant applications form a crucial component of the Sterrewacht's research funds. We were particularly proud that a total of four awards from the NWO Vernieuwingsimpuls came our way: VIDI grants for Joop Schaye and Yuri Levin, and VENI's for Clovis Hopman and Herma Cuppen. Two EU networks in which Leiden plays a significant role were also awarded, one for GAIA-related research, and one for gravitational lensing surveys. Added to these successes came the important news that funding for the national NOVA programme is to be continued until 2013 at

least. The future thus looks bright for astronomy in Leiden (and indeed, the Netherlands as a whole).

In outreach, the evening lectures / telescope viewing nights at the old Observatory building downtown drew big crowds, young and old --- the enthusiastic organization of these events by Leiden promovendi and members of the Student Dispuut Kaiser, as well as the Werkgroep Leidse Sterrewacht, is an important part of our local outreach activities. As every year, sterrewachters also participated in the National Science day, again hosting many hundreds of visitors at the old Observatory. The UNAWE programme, which promotes exposure to the excitement of astronomy for disadvantaged children throughout the world, received a direct grant from the Ministry of OC&W, delivered in person by Minister Maria van der Hoeven.

The year also saw the departure of many PhD students and postdocs, most of whom have gone on to continue a career in astronomy elsewhere. Also in the permanent staff there were a few changes. Two Sterrewachters joined the permanent staff: Anthony Brown, whose work on the GAIA mission will help to ensure a strong Leiden involvement once the satellite flies in the 2010's, and Remko Stuik who runs the optics laboratory and is involved in the ambitious MUSE instrument for the ESO VLT. The support staff was strengthened with the appointment of Christine Gündisch who will help with managing the increasingly complex grants and contracts that the many projects we are involved in entail.

Andreas Quirrenbach left us after a 4-year stay to return to Germany as director of the venerable Landessternwarte in Heidelberg. During his time in Leiden Andreas started a number of high-profile instrumentation projects, and happily several of these, which involved other Leiden staff as well, can continue here.

At the end of the year it became known that our scientific director Tim de Zeeuw had been selected to be the next Director General of the European Southern Observatory, one of the pre-eminent astronomical organizations in the world, starting in September 2007. This will make him the 4th Dutch ESO DG (out of 7!), and also the 4th to have a strong Leiden connection. We wish Tim well with the enormous challenge that comes with this prestigious appointment.

As has become tradition, the year was closed with a fabulous Christmas lunch to which everyone brought something typical of their own country. The resulting culinary feast nicely summed up how wonderful it is to work at such an internationally oriented institute.

We look forward to an even more successful 2007!

Koen Kuijken

Deputy Director

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 2006. 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 2006.

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 236 of these objects by the Minor Planet Center (Cambridge, USA) in 2006. 22 names were given to minor planets discovered by the Van Houtens in 2006. Of particular interest are: (10966) van der Hucht, (10968) Sterken, (10970) de Zeeuw, (10971) van Dishoeck, (10950) Albertjansen, (10964) Degraaff, (10250) Hellahaasse, (10251) Mulisch, (10969) Perryman, (10252) Heidigraf, (10658) Gretadevries, which have been named after Belgian or Dutch famous people.

2.1.2. Comets

Hogerheijde studied the volatile content of cometary nuclei, as probes of the compositions of the young Solar System. Using the millimeter interferometer of the Berkeley-Illinois-Maryland Association at Hat Creek, California, together with researchers from Berkeley, Caltech, and Illinois, in 2006 he investigated the presence of large molecules such as methanol, methyl cyanide, ethanol, and methyl formate in the comae of comets LINEAR (C/2002 T7) and NEAT (C/2001 Q4). These two comets show distinct abundance patterns reminiscent of the differences found earlier toward HaleBopp and Hyakutake. This indicates that comets can have very different chemical compositions, probably linked to their location of formation and thermal histories.

2.2. Exoplanets

2.2.1. Transisting Planets

Snellen continued his work on the detection and characterisation of transiting extrasolar planets, in particular on near-infrared observations of the primary and secondary eclipses. Measurements of planet OGLE-TR-113 using SOFI on the ESO New Technology Telescope were a great success, resulting in unprecedented precisions of 1 millimag per 10 minutes. The observations of the transit show a flat-bottomed light-curve indicative of a significantly lower stellar limb darkening at near-infrared than at optical wavelengths. The observations of the secondary eclipse result in a 3σ detection of emission from the exoplanet at 0.17±0.05 per cent. If true, these would constitute the first detection of direct emission from an extrasolar planet from the ground, however, residual systematic errors make this detection rather tentative.

2.2.2. SETI

Ollongren further extended his Lingua Cosmica, as before in collaboration with the research group on Interstellar Message Construction of the SETI Institute at Mountain View, California. Aristotelian logic was

embedded in the system. Results were reported at the 57th International Astronautical Congress in Valencia.

2.3 Protostars and Circumstellar Disks

2.3.1. Characterizing Young Disks

In the deeply embedded stage of star formation, the young stellar object (YSO) is surrounded by a dense envelope of gas and dust which is gradually dispersed with time. A particularly interesting evolutionary phase is the Class I stage, in which the disks are still young but the envelopes are largely dispersed so that they no longer overwhelm the disk emission. Lommen, van Dishoeck, Crapsi and Joergensen (CfA) started a program to use the SubMillimeter Array (SMA) to determine the physical and chemical characteristics of young disks for a set of Class I sources. Results for the first two sources, IRS 63 and Elias 29 in Ophiuchus, reveal a large range in disk properties, with disk masses from <0.006 to 0.05 M_{Sun} and M_{env}/M_{disk} from 1 to 6. The latter values are clearly in between those of the Class 0 (>10) and Class II (<1) stages. HCO^+ 3-2 is detected, with position-velocity diagrams indicative of Keplerian rotation. This allows an estimate of the stellar masses at this early stage for the first time.

2.3.2. Testing Grain Surface Chemistry in Massive Hot Cores

Bisschop, van Dishoeck, de Wachter and Joergensen (CfA) finalized their JCMT submillimeter line survey toward 7 high-mass YSOs to search for H_2CO, CH_3OH, CH_2CO, CH_3CHO, C_2H_5OH, HCOOH, HNCO and NH_2CHO. The aim was to establish the chemical origin of this set of complex organic molecules which are thought to be produced by grain surface chemistry. Based on their rotation diagrams, these molecules can be classified as either cold (<100 K) or hot (>100 K), implying that complex organics are present in at least two distinct regions. Furthermore, the abundances of the hot oxygen-bearing species are correlated, as are those of HNCO and NH_2CHO. This is suggestive of chemical relationships within,

but not between, those two groups of molecules. The most likely explanation for the observed constant abundance ratios is that the hot molecules are "first generation" species that originate from solid-state chemistry. The correlations between sources imply very similar conditions during their formation or very similar doses of energetic processing. Bisschop and collaborators have subsequently tested various proposed routes through laboratory experiments of the hydrogenation of simple ices (see Section Laboratory Astrophysics).

2.3.3. PAH vs. Large Grain Distribution in Disks

Geers, van Dishoeck, Merin, Oliveira, together with Pel (Groningen), Pontoppidan (Caltech), Dullemond (Heidelberg) and Augereau (Grenoble) obtained spatially resolved VLT-VISIR mid-infrared images of the disk surrounding the young star IRS 48 in Ophiuchus. The disk exhibits a ring-like structure at 18.7 micron, and is dominated by very strong emission from polycyclic aromatic hydrocarbons (PAHs) at shorter wavelengths (Figure 2.1). This allows a detailed study of the relative distributions of small and large dust grains. The 18.7 micron ring peaks at a diameter of 110 AU, with a gap of ~ 60 AU. In contrast, the PAH emission bands are centered on the source and appear to fill the gap within the ring. The measured PAH line strengths are 10-100x stronger than those typically measured for young M0 stars and can only be explained with a high PAH abundance and/or strong excess optical/UV emission. The morphology of the images, combined with the absence of a silicate emission feature, imply that the inner disk has been cleared of micron-sized dust but with a significant population of PAHs remaining. It is argued that the gap can be due to grain growth and settling or to clearing by an unseen planetary or low-mass companion. IRS 48 may represent a short-lived transitional phase from a classical to a weak-line T Tauri star.

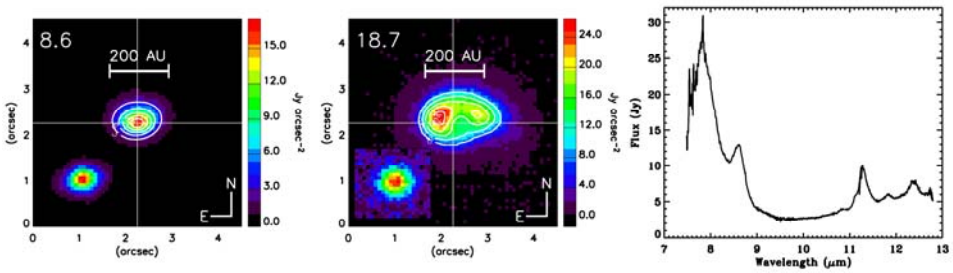

Figure 2.1: VLT-VISIR mid-infrared images of the disk around the young T Tauri star IRS 48, showing strong centrally peaked PAH emission at 11.3 micron as well as a 60 AU diameter gap devoid of large grains emitting at 19 micron. The inserts show the PSF of a standard star. The 8-13 micron VISIR spectrum with the strong PAH features is included (Geers et al.)

2.3.4. Spitzer Spectroscopy of Disks: [Ne II] and H_2

Van Dishoeck and collaborators continued harvesting the scientific fruits of the Spitzer Space Telescope 'Cores to Disks' (c2d) legacy project, led by Evans (Texas). Many papers were completed, including presentation of the IRAC and MIPS maps of the nearby molecular clouds. All reduced IRS spectra were delivered to the Spitzer Science Center with extensive documentation provided by Lahuis and Kessler-Silacci (Texas).

One of the spectroscopc highlights is a survey by Lahuis, van Dishoeck, Blake, Pontoppidan (both Caltech), Evans and Kessler-Silacci of mid-infrared gas-phase lines toward a sample of 76 circumstellar disks around low mass pre-main sequence stars. [Ne II] and [Fe I] are detected for the first time toward classical T Tauri stars in ~20 % respectively ~9 % of the c2d sources. The observed [Ne II] line fluxes are consistent with X-ray irradiated disks around stars with L_X=1029-1031 erg s-1. [Fe I] is detected, but not [S I] or [Fe II]. The [Fe I] detections indicate the presence of gas-rich disks with masses of >0.1 M_{Jup}. No H_2 0-0 S(0) and S(1) disk emission is detected, except for S(1) toward one source. These data give upper limits on the warm (T~100-200K) gas mass of a few Jovian masses, consistent with recent T Tauri disk models which include gas heating by stellar radiation. Compact disk emission of hot (T>~500K) gas is observed through the H_2 0-0 S(2) and/or S(3) lines toward ~8 % of our sources. These line fluxes are higher by more than an order of magnitude than those predicted by recent disk

models, even when X-ray and excess UV radiation are included. Oblique shocks of stellar winds interacting with the disk can explain many aspects of the hot gas emission, but are inconsistent with the non-detection of [S I] and [Fe II] lines.

2.3.5. Chemistry in Evolving Protoplanetary Disks

Jonkheid, van Dishoeck, Hogerheijde and Dullemond (Heidelberg) explored the chemistry and gas temperature of evolving protoplanetary disks with decreasing mass or dust settling, and tested the sensitivity of various gas-phase tracers. The density and dust temperature profiles for a range of disk models around a typical Herbig Ae star were used together with 2-dimensional ultraviolet radiative transfer to calculate the chemistry and gas temperature. The chemistry shows a strong correlation with disk mass. Molecules that are easily photodissociated, like HCN, require high densities and large extinctions before they can become abundant. The products of photodissociation, like CN and C_2H, become abundant in models with lower masses. Dust settling mainly affects the gas temperature, and thus high temperature tracers like the O and C+ fine structure lines. The carbon chemistry is found to be very sensitive to the adopted PAH abundance. The line ratios CO/^{13}CO, CO/HCO^+ and [O I] 63 /146 micron can be used to distinguish between disks where dust growth and settling takes place, and disks that undergo overall mass loss.

2.3.6. Molecular Excitation and Radiative Transfer Tool

The large quantity and high quality of modern radio and infrared line observations require efficient modeling techniques to infer physical and chemical parameters such as temperature, density, and molecular abundances. Van der Tak (Groningen), Schoeier (Stockholm), Black (Onsala) and van Dishoeck presented a computer program to calculate the intensities of atomic and molecular lines produced in a uniform medium, based on statistical equilibrium calculations involving collisional and radiative processes and including radiation from background sources. Optical depth effects are treated with an escape probability method. The program is available on the World Wide Web and makes use of molecular data files maintained in the Leiden Atomic and Molecular Database (LAMDA), which

will continue to be improved and expanded as part of the Dutch ALMA ARC activities.

2.3.7. From Molecular Clouds to Stars and Planets

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 (see 2.4.1), as well as 'late' phases represented by comets as left-overs from the early Solar System (see 2.1.2). In his 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 his research, Hogerheijde works with postdoc A. Crapsi, and graduate students C. Brinch, O. Panić, and D. Salter, as well as several master's students (Martinez, van Weeren, Schouten, and Kockx).

2.3.8. Warm Gas in a Protoplanetary Disk

Together with colleagues from Harvard, Michigan, and Caltech, Hogerheijde reported the interferometric detection of the CO J=6-5 rotational transition from the protoplanetary disk around the young star TW Hya using the Submillimeter Array on Hawaii. At a distance of only 56 pc this disk is the closest view available for a gas-rich disk still in the process of forming a planetary system. Earlier studies of the thermal emission of the dust already gave detailed insight into the structure of the disk, while observations of lower rotational transitions of CO confirmed Keplerian rotation in the disk. Surprisingly, the CO 6-5 line, which traces relatively warm gas of 50-100 K, is significantly stronger than expected. We

hypothesized that X-ray emission from TW Hya creates a hot layer at the surface of the disk responsible for this excess emission, illustrating the interaction between the stellar accretion-driven activity and the make-up of the surrounding disk.

2.4 Star Formation

2.4.1. Deuterium-carrying Molecules in Prestellar Cores

Hogerheijde reported the detection of the molecular ion H2D+ in the prestellar core Barnard 68 with the newly commissioned APEX telescope. This ion has a groundstate transition emission line at a frequency of 372 GHz, near a strong atmospheric absorption band, and requires the clear skies of Chajnantor for reliable observation (Fig. 2.2). The H2D+ ion fills an essential role in interstellar chemistry: its non-deuterated counterpart, H3+, originates via cosmic ray ionization of H2, and initiates much of the chemical reactions inside dense and cold clouds. The reaction of H3+ with HD (deuterated H2) produces the energetically slightly more favorable H2D+. At the low temperatures of 10 K found inside prestellar cores, this reaction strongly enhances the relative abundance of the H2D+ ion, and as a consequence, of other deuterium-bearing species. These enhancements are observed to be as large as 3-4 orders of magnitude. Accurate determination of the H2D+ abundance is essential to understand this process and calibrate chemical calculations. The prestellar core Barnard 68 is an ideal testbed for this, because its density and temperature have been established with great accuracy in the literature, allowing the observed line intensity to be converted to a molecular abundance with great precision. From our APEX observations we find that the H2D+ line strength and abundance are in accordance with theoretical expectations, but also that better spectroscopic constants are required from laboratory measurements to reach the necessary accuracy.

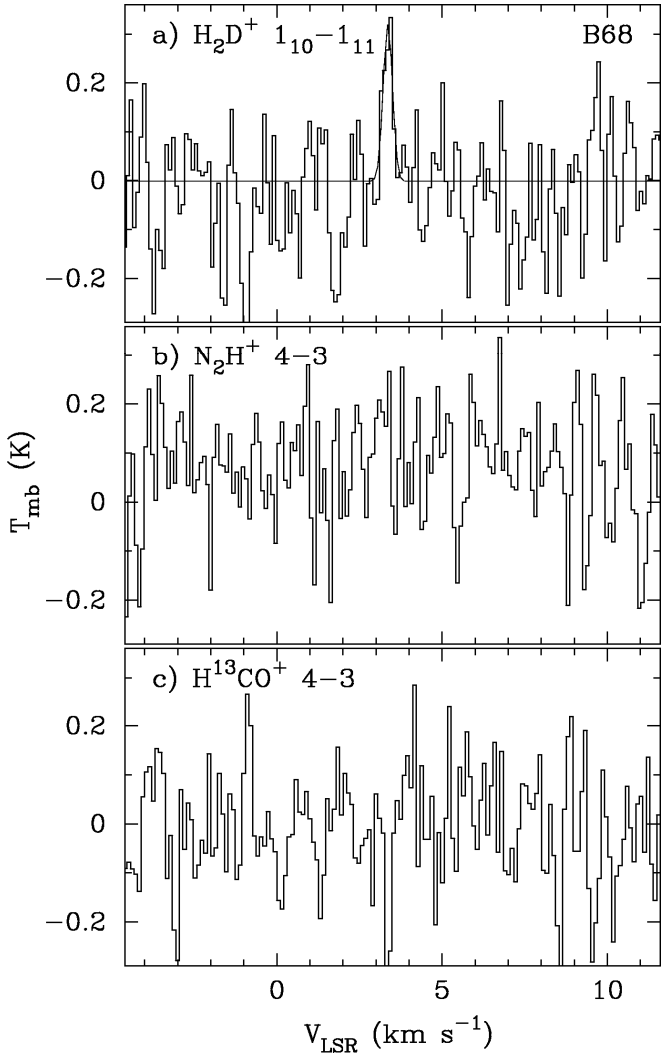

Figure 2.2: Detection spectrum of H2D+ 110-111 toward the prestellar core Barnard 68, obtained during Science Verification of the newly commissioned ESO/Max Planck/Sweden Atacama Pathfinder EXperiment telescope (APEX) on Chajnantor, Chile. The top panel shows the H2D+ line. Panels b and c show non-detections of N2H+ and H13CO+ toward the same position. Image from Hogerheijde et al. (2006, A&A, 454, L59).

Crapsi, together with Fontani (INAF), and collaborators, expanded the study of the deuteration around protostars to higher masses, and tested deuterium fractionation as a tool to identify the coldest and therefore earliest stages of high-mass star formation. They observed N2D+, N2H+, C17O and sub-millimeter continuum using the IRAM-30m and JCMT, and found that in seven sources (out of ten) the [N2D+]/[N2H+] was enhanced by 3 orders of magnitudes over the interstellar D/H ratio. These observations show that the chemical properties of the clouds in which high-mass stars are born are similar to their low-mass counterparts.

Together with colleagues from Harvard, Michigan, and Caltech, Hogerheijde reported the interferometric detection of the CO J=6-5 rotational transition from the protoplanetary disk around the young star TW Hya using the Submillimeter Array on Hawaii. At a distance of only 56 pc this disk is the closest view available for a gas-rich disk still in the process of forming a planetary system. Earlier studies of the thermal emission of the dust already gave detailed insight into the structure of the disk, while observations of lower rotational transitions of CO confirmed Keplerian rotation in the disk. Surprisingly, the CO 6-5 line, which traces relatively warm gas of 50-100 K, is significantly stronger than expected. We hypothesized that X-ray emission from TW Hya creates a hot layer at the surface of the disk responsible for this excess emission, illustrating the interaction between the stellar accretion-driven activity and the make-up of the surrounding disk.

2.4.2. Massive Star Formation

The work of Van Langevelde, Hill and Torstensson focuses on high-mass star formation regions. In particular, they are interested in the youngest massive stars, as well as the prenatal environments in which these objects form. Methanol masers are useful tools for identifying such regions and may possibly used to characterize the evolutionary stage and kinematics of such regions to very small scales.

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 evolutionary stages of the evolution of a massive star. However, 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 star formation regions exhibiting signs of methanol maser emission, one of the earliest evolutionary tracers of high-mass stars.

Van Langevelde and Torstensson began a research project starting with high resolution, astrometric, wide field VLBI imaging. Data from the European VLBI Network can be used to pinpoint the location where methanol is abundantly present and special excitation conditions prevail. A number of nearby regions were observed and special processing tools were developed to find the methanol signposts in the arcminute size fields with mas resolution. The goal of the project is to characterize the radio and (sub)mm signature of the young massive star at the origin of the methanol maser. In collaboration with Bartkiewicz (Torun, Poland), images were made of targets from a blind survey. In this study a unique ring shaped methanol maser was discovered, which is being followed up with proper motion observations and attempts to detect the central source. A common result is that in sources where the central source can be found, the methanol maser is typically found on 500 - 1000 AU scales.

Whilst Hill continued her work on a millimetre continuum sample derived initially from radio continuum and methanol maser selected sources. This program included analysing results from a spectral energy distribution analysis of the source sample. The results indicate a sample of millimetre continuum sources that are possibly indicative of the earliest stages of massive star formation prior to the onset of methanol maser emission. Analysis of this millimetre continuum sample, revealed it to have a two-temperature distribution. The cooler sources in this sample are interpreted as young, cool, star-less sources whilst the warmer sources are thought to be the precursors of methanol masers and hence indicative of the youngest massive stars.

2.4.3. Spitzer Observations of the Galactic Starburst W49A

Bos and Brandl studied the HII region W49A, the highest concentrations of young, massive protostars in our Galaxy. They investigated the physical and chemical properties of the protostars via mid-IR spectroscopy. The most massive sources reveal very different spectral properties, which describe their evolutionary state. Amongst them in the most luminous water maser source in our Galaxy, a heavily embedded protostar which shows pronounced absorptions features of CO2 ice. The spectral signatures suggest a self-shielded geometry, with a luminous central star which has started to disperse its surrounding gas and dust envelope.

2.5 Stars and Circumstellar Matter

2.5.1. η Carinae, Wolf-Rayet stars

Van Genderen, Sterken (Brussels), Allen (New Zealand) and Walker (New Zealand) used new and archived ground-based optical and NIR (covering 35 yr) and space-based (HST) narrow-band photometry, in order to document the morphological character of optical and NIR features (amongst others a light peak followed by a eclipse-like dip) at seven periastron passages of the highly eccentric supermassive binary η Carinae (P = 5.54 yr), of the secular brightening 1952-1998, of the brightening episodes after the 1997.9 and 2003.5 periastron passages, and of two types of UV oscillations.

The light peaks ($0\overset{m}{.}1$) are not caused by a hot spot nor by a flare, but are more likely the climax of the expansion phase of the primary due to tidal forces. The dips ($0\overset{m}{.}1$) following the light peaks, can be explained by the obscuration of the secondary's emitting circumstellar structure when it enters the wind of the primary. The long-lasting deficit of each post-periastron L- and K-band radiation is explained by the model of Soker (2006) and Akashi et al. (2006) involving the temporary annihilation of the wind by the collapse of the colliding wind region onto the secondary.

The wavelength dependency of the rates of the slow secular brightening of the circumstellar structure , the Homunculus, and of the fast brightenings of the central star and Homunculus after the 1997.9 and 2003.5 events are investigated. The brightenings can be interpreted as an extinction decrease with an extinction law R~5.

The primary's luminosity was likely stable over the last 35 yr. The long-term UV oscillations (Balmer continuum radiation) are interpreted as revolution-modulated H-emission variation in the equatorial plane, whereas the short-term UV oscillations (a few 100 d) are probably due to stellar pulsations.

Veijgen, van Genderen, van der Hucht (Utrecht, SRON) and Sterken (Brussels) completed the investigation of the photometric behaviour of the WC9-type Wolf-Rayet star WR 103 = HD 164270. Three different photometric systems were used for the monitoring. The analysis of variance technique was used to search for a periodicity, and the effective transmission curves were constructed to investigate the influence of the strong emission lines in each filter.

As the stellar pulsations of Wolf-Rayet stars have to propagate a long way up to the thick wind layers from which we receive the continuum light and the emission lines, it is comprehensible that light and line variations will be usually difficult to analyze and that they often look not periodic at all. That is presumably the reason that the light variations look stochastically. The time scale hovered between a few hours up to a few days, and likely even longer. The light amplitude ~0.1 magnitude and mainly due to continuum variations. Small line emission variations of a few percent are clearly detectable in the Strömgren filter due to the presence of a prominent CIII emission line, which contributes about 50 % to the total flux in this filter. This line emission variability is supposed to be caused by dense moving clumps: small scale structures in the wind related to localized random shocks, accelerated outward along radial trajectories. The size of the light amplitude of WR 103, agrees with the theoretical and empirical expectation that it should be larger than the light variations of WN-type stars, which are less evolved and consequently more hydrogen abundant.

2.6 Structure of the Milky Way

2.6.1 Galactic Magnetic Field Excitation of Galaxy Nuclei by X-rays, UV Photons and Cosmic Rays

Schnitzeler and Katgert finished their work on the analysis of the WENSS polarization data, and started working on the new multi-frequency datasets. Faraday tomography of these datasets enables studying the distribution of regions with synchrotron emission and Faraday rotation along the line-of-sight. Schnitzeler has worked on a reduction pipeline for these (large) datasets. The data Schnitzeler and Katgert have analysed in the direction of the Galactic anticentre look promising, showing large variations in Faraday depth with galactic position, and they have worked on understanding the physical properties that are producing these effects.

2.6.2. 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 accepted for publication.

2.7 Nearby Galaxies

2.7.1. 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.

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. About ten galaxies now have good datasets. A highlight of 2006 was the completion 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 larger sample of galaxies is therefore needed in order to integrate out over projection angles. Streamlined processing of the other galaxies in the sample, as well as further data taking, is underway.

Falcón-Barroso, McDermid and de Zeeuw, together with Cappellari (Leiden/Oxford) contributed to work lead by van de Ven (Leiden/Princeton) on a study of the famous Einstein Cross gravitational lens system. Using a combination of lensing and stellar dynamics, this study addresses the dark-matter content and distribution of the lens galaxy. Initial results show that dark matter does not dominate the central regions of galaxies, and seems to be distributed in a similar way to the luminous component, at least on kiloparsec scales.

Weijmans, Cappellari and Van Scherpenzeel observed the outskirts of two elliptical galaxies (NGC 821 and NGC 3379) with the integral-field spectrograph SAURON. The observations were pointed at 2, 3 and 4 half-

light radii. Aim of these observations is to obtain the line-of-sight velocity distribution at these radii, needed to constrain the mass distributions of the two galaxies, and establishing the presence of a dark matter halo. Previous observations were plagued by bad weather conditions, though preliminary results pointed at the presence of dark matter in NGC 3379. Reduction of these new observations has started.

In addition to the observations described above, Weijmans and Gerssen (Potsdam) observed the elliptical galaxy NGC 821 with the integral-field spectrograph PPAK, which has a larger field of view than SAURON. The spectrograph was pointed at 2.5 half-light radii, but due to bad weather conditions, no useful data was obtained. Re-observations are scheduled for 2007.

Weijmans, together with Krajnovic (Oxford) analysed the velocity field of E4 galaxy NGC 2974. The velocities were extracted from the ionised gas, obtained with the integral-field spectrograph SAURON, and the neutral gas, obtained with the VLA. They conclude that the galaxy is surrounded by a halo of dark matter, and that this halo is consistent with an axisymmetric shape.

Welles (Nijmegen) together with Weijmans, studied the Sa galaxy NGC 1056. He analysed the velocity field of both the ionised gas (obtained with the integral-field spectrograph SAURON) and the neutral gas (obtained with WSRT), and extracted a rotation curve. Preliminary results show that the velocity remains high in the outer parts of the galaxy, indicating the presence of a dark matter halo.

2.7.2. 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 was delayed, but this gave time for the development of new techniques for accurate measurement of the lensing effect. Kuijken published a method based on `shapelets', in which sources are described by means of a set of orthogonal basis functions with nice mathematical

properties. He took part in the `Shear Testing Programme' (STEP) in which different codes are compared in a series of blind tests, and the method fared well (though there is room for improvement). Interestingly, nearly all participants have been able to increase the accuracy of their codes as a result of participation in this experiment.

From 2007 the KiDS project will benefit from Leiden's participation in a European training network, 'DUEL', approved in 2006, which will fund a PhD student and a postdoctoral fellow.

2.7.3. Molecules in Galaxy Nuclei

One of Israel's main research interests concerns the massive concentrations of dense molecular gas frequently found in the central regions of late-type galaxies. Before the evolution of such concentrations (black hole infall, jet expulsion, starburst consumption etc) can be studied, fundamental properties such as excitation and mass need to be determined. Such information is provided by extensive observing programs of molecular line emission from a range of species in various transitions, but usually not in a direct manner. Interpretation of observed intensities in terms of physical paramters requires the development of models that simulate the physcs of such objects.

The nuclei of active galaxies harbor massive young stars, accreting black holes, or both. In order to determine the physical conditions of the molecular gas close to these sources of radiation, Meijerink, Spaans (Univ. of Groningen) and Israel constructed numerical models. These models determine both the thermal and the chemical balance of molecular gas exposed to X-rays (XDR) and far-UV (PDR) radiation as a function of cloud depth. They presented their results as a grid of XDR and PDR models spanning a ranges in volume density, irradiation and column density, and identified various line intensity ratios and combinations thereof as diagnostic tools to differentiate between (volume) excitation by X-rays and (surface) excitation by UV photons. Useful as such are the [SiII]/[CII] fine structure line ratio, and the HCN/HCO+, HNC/HCN, and CN/HCN molecular line ratios, as well as the higher CO J=N+1-N/CO 1-0, N>=1 molecular line ratios observable with the future HIFI/Herschel space

observatory. Column density ratios indicate that CH, CH+, NO, HOC+ and HCO may also be good PDR/XDR discriminators.

In order to gauge the potential effect of cosmic rays on molecular gas excitation in active galaxy centers, Meijerink, Spaans and Israel also constructed PDR (UV-excitation) models with both `normal' and highly elevated cosmic-ray intensities, and compare these to those obtained for XDRs. They obtain larger high J (J>10) CO ratios in PDRs in the presence of highly elevated cosmic ray emission, but these ratios are always exceeded by the corresponding XDR ratios. They noted that neutral carbon to ^{13}CO line ratio are a reasonable tracer of enhanced cosmic ray fluxes in relatively low-density PDRs (n = 1000 cc). They founfd that the HCN/CO and HCN/HCO+ molecular line ratios, when combined with high J CO emission lines, do distinguish PDRs and XDRs under both low and high cosmic ray irradiation conditions.

2.7.4. MIDI Observations of AGN

Jaffe continued his work on midInfrared interferometric observations of AGNs with the VLTI instrument MIDI. The reduction of the large observing program on NGC~1068 with the 8-m VLTI UTs is essentially complete and shows that the disk is tilted with respect to the radio axis, an unexpected result. Shorter baseline AT observations are planned to map the cooler dust at larger radii, and the transition from the "obscuring torus" to the wind driven Narrow Line regions.

The first interpretations of the Circinus galaxy and Cen A have been published by Meisenheimer and Tristriam at MPIA Heidelberg, in collaboration with Jaffe and Raban and Israel at Leiden. Circinus seems quite similar to NGC 1068, by NGC 5128 is clearly different, dominated by synchrotron emissioin rather than thermal dust. There appears to be a weak dust disk however. Further MIDI observations are planned to characterize the dust better, and a VISIR/VLBI/X-ray campaign is being planned to map the dust structures by infrared reverberation mapping.

2.7.5. Cooling Flows

With Malcolm Bremer at Bristol Jaffe continued studies of the "cooler" gas phases of cooling flow galaxies with deep VLT spectra (ISAAC and FOS) and with Spitzer midIR spectra. These show that the molecular gas, with temperatures of 300-2000 K is a significant energetic component of the gas phase; its luminosity is comparable to that of the ionized gas at ~ 10000 K. It is very difficult to keep this gas warm because of its rapid cooling rate. The current reduction of the spectra indicate that heat sources in addition to stellar or non-stellar photoionizing sources are needed. A new OIO, Raymond Oonk is reducing integral field SINFONI spectra taken of three clusters. New HST observations are scheduled to characterize the Far-UV spectrum that is ionizing the HII gas, while Spitzer observations of high-redshift galaxy forming regions are scheduled to see whether their spectra agree with nearby cooling flows.

2.7.6. Starburst Galaxies

The research of Van der Werf and his group concentrates on dusty starburst galaxies. Nearby starburst galaxies and ultraluminous infrared galaxies (ULIRGs) are studied, as well as their more luminous counterparts at high redshift, that are detected at infrared and (sub)millimetre wavelengths.

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. While such objects are rare locally, they are much more common at high redshift and produce an important fraction of the cosmic energy output and star formation rate at redshifts of 2 to 3. Such high-z ULIRGs are now routinely detected as submillimetre galaxies (SMGs). The interest of the SMGs lies not only in their prodigious star formation rates but also in the fact they are likely forming a nuclear supermassive black hole; if this is correct, the now well-documented relation between mass of the stellar spheroid and nuclear black hole mass likely originates in the ULIRG phase.

In 2006, this work concentrated mostly on detailed observational studies of nearby starburst galaxies using near- and mid-infrared ground-based imaging and spectroscopy. This work is carried out by Snijders (mid-IR observations with VISIR/VLT and Spitzer) and Vermaas (near-IR observations with SINFONI/VLT) under supervision of Van der Werf. While local starburst galaxies are not as luminous as their more extreme high-z cousins, they can be studied in much greater detail and furnish excellent local laboratories. A highlight of this work was the ground-based mid-IR study of the Antennae (NGC4038/39) published by Snijders et al. Ground-based mid-IR work has the enormous advantage over space-based observations with Spitzer that much higher spatial resolution is obtained. With VISIR at the VLT the diffraction limit of 0.3" at 10 microns is routinely obtained, about a factor 100 better (in area) than Spitzer at the same wavelength. This results in quantitatively different derived parameters. An illustration is given in Fig. 2.3, which shows VISIR/VLT imaging of the two most spectacular superstarclusters in the Antennae. The VISIR data resolve the most spectacular (Eastern) cluster into several components, which are embedded in a common envelope of PAH emission. The detection of strong [SIV] line emission indicates substantial recent star formation in a high-density environment, typical for compact HII regions in our Milky Way, but here extended over at least 50 pc. Another remarkable result is the low equivalent width of the PAH emission, which indicates that the PAH emission is dominated by a diffuse component, not only and not directly related to the most recent star formation.

Work on high-redshift starburst galaxies continued in 2006 with a SINFONI study of the kinematics of infrared-selected high-z galaxies by Van Starkenburg under supervision of Van der Werf, and with preparation of future submillimetre surveys. Surveys for SMGs will receive a considerable boost from the advent of the next generation of (sub)millimetre survey camera's, and in particular SCUBA-2. Van der Werf is one of the 4 Principal Investigators of the SCUBA-2 Cosmology Legacy Survey, the largest single program ever scheduled on the JCMT, and the final field selection for this survey was completed in 2006.

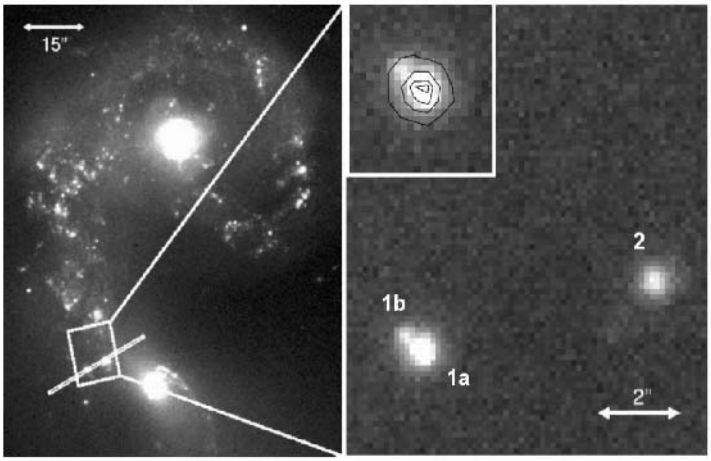

Fig. 2.3: Left panel: SoFI Ks band (2.16 micron) of the Antennae. The VISIR slit is shown in white; North is up, and East is left. Right panel: VISIR [Ne II] 12.81 micron image of the overlap region, inserted: sources 1a and 1b in the [Ne II] 12.81 micron filter with the contours of PAH 11.25 micron filter emission overlaid.

2.7.7. Superstarclusters

Snijders and Van der Werf took a major step forward in the study of massive young superstarclusters in nearby starburst galaxies by obtaining high spatial resolution mid-infrared (10 and 20 μm) imaging and spectroscopy with the new VISIR instrument at the ESO VLT. Comparison with Spitzer spectra (through a larger slit) reveals very interesting differences: the VISIR data reveal higher excitation, indicating that the VISIR spectra zoom in on the youngest regions. Interestingly, the equivalent width of PAH emission at 11.3 μm is much lower in the VISIR spectra. These results show that VISIR begins to resolve the individual ionized and molecular gas complexes that together make up the starburst.

2.7.8. Nearby Clusters of Galaxies

Katgert and Thomas (Enschede) studied the structural properties of cluster galaxies of different morphological types. Using a large subset of the

galaxies in clusters from the ESO Nearby Abell Cluster Survey, they have studied the relation between the morphological classification (according to the standard procedures of expert visual classifiers) and the results of a bulge-disk decomposition (using GIM2D) based on CCD-imaging data obtained for the same galaxies. The expected correlation between morphological type and bulge fraction is recovered, but the distributions of bulge fraction for the different types show considerable overlap. E.g. a sizable fraction of ellipticals shows an exponential disk component, while the arly spirals can have sizable bulges. A comparison is made of the properties of the disks of spirals in and outside of clusters, and a discussion is given of the exponential components in elliptical galaxies.

Katgert and Biviano (Trieste) have studied the evidence for kinematical and dynamical substructure in the clusters in the ESO Nearby Abell Cluster Survey. They have devised a new method to quantify the probability that a given galaxy finds itself in cold and/or moving group within its cluster. For groups of neighbours (in projection) with varying size around each galaxy, the probability that the observed configuration arises by change from a smooth model is first calculated. This probability can subsequently be translated into the likelyhood that the galaxy in question is indeed a member of a cold and/or moving group, once the total number of galaxies in such substructures has been derived. The results of this analysis are very promising as the identification of substructures appears quite convincing.

2.7.9. The Infrared Properties of Blue Compact Dwarf Galaxies

Together with collaborators at Cornell University Brandl investigated the properties of a large sample of blue compact dwarf (BCD) galaxies. A central question for these systems is how metallicity, the interstellar radiation field (ISRF) and the abundance of the polycyclic aromatic hydrocarbons (PAHs, small carbon-based dust grains) are related. While there is only a weak anticorrelation between the hardness of the ISRF and the strength of the PAH features a much stronger anticorrelation was found between the PAH strength and the product of radiation hardness and the UV luminosity density. They concluded that the PAH strength in BCD galaxies is determined by a combination of PAH formation and destruction effects.

2.7.10. Starbursts at Low Metallicity

Beirao and Brandl analized IRS spectra of the nearby, low-metallicity starburst galaxy NGC 5253. They studies the properties of the ISRF with distance from the ionizing super star cluster out to 250 parsec, radially. Over that distance, the radiation hardness drops by a factor four while the relative strength of the PAH feature increases with distance, demonstrating the counterbalance between radiation field and the presence of molecules in the ISM. These results also demonstrate the importance of spatially resolved mid-IR spectroscopy.

2.7.11. The SAURON Project

De Zeeuw, Van den Bosch, Cappellari, Falcón-Barroso, McDermid and Weijmans are members or associates of the SAURON project: a survey of 72 nearby early-type galaxies using the innovative SAURON integral-field spectrograph at the 4.2m William Herschel Telescope on La Palma. Started in 1999, in collaboration with Davies (Oxford) and Bacon (Lyon), the observations were completed in 2003, with ongoing analysis and follow-on projects since then. By the end of 2006, the first eight major survey publications were in print, with numerous additional related publications on associated projects. A number of these were completed in 2006.

Falcón-Barroso, together with McDermid, and de Zeeuw contributed to the study of the stellar populations analysis of the representative sample of 24 Sa galaxies part of the SAURON survey, lead by Peletier (Groningen). They find that Sa galaxies on the average have slightly smaller Mgb and Fe5015 line strengths than ellipticals and S0s, and higher Hβ values, but with a much larger scatter. The absorption line maps show that many galaxies contain some younger populations (<= 1 Gyr), distributed in small or large inner discs, or in circumnuclear star forming rings. In many cases these young stars are formed in circumnuclear mini-starbursts, which are dominating the light in the centres of some of the early-type spirals. These mini-starburst cause a considerable scatter in index-index diagrams, more than is measured for early-type galaxies. Their results reveal that galactic bulges in this type of galaxies are formed by at least 2 components: a thin, disc-like component, often containing recent star formation, and another, elliptical-like component, consisting of old stars and rotating more slowly,

dominating the light above the plane. This picture is able to explain in a natural way the heterogeneous stellar populations and star formation characteristics that are seen in detailed observations of early-type spiral galaxies.

McDermid and Falcón -Barroso contributed to work lead by Ganda (Groningen) looking at the two-dimensional absorption-line strengths of a sample of late-type spiral galaxies in order to explore their stellar populations and star-formation histories. The SAURON integral-field spectrograph was used, together with techniques for separating the nebular emission and stellar absorption lines and applying stellar population models. As well as mapping the detailed stellar populations in this class of galaxy for the first time, it was found that the dynamically more massive spirals have older populations and shorter formation time-scales than the less massive galaxies, which still have significant ongoing star-formation.

De Zeeuw, McDermid, Cappellari and Weijmans contributed to a follow-up survey lead by Morganti (Dwingeloo) looking at the HI content of a subset of SAURON galaxies using the Westerbork Synthesis Radio Telescope. Neutral hydrogen is detected in 70 % of these (field) galaxies, showing a clear connection to the ionized gas observed in the central regions with SAURON. A variety of HI morphologies was found, but surprisingly little correlation with other galaxy properties, such as stellar populations and dynamical structure. The occurrence and morphology of the gas suggests, however, that early-type galaxies continue to build their mass up to the present day.

Rusli, with supervision from McDermid, embarked on analysis of the stellar populations in a small sample of early-type galaxies observed with the OASIS integral-field spectrograph (WHT). This is part of a follow-up survey of SAURON galaxies at higher spatial resolution using OASIS. The data were reduced, and initial results show cases of embedded disks and KDCs, and central stellar populations consistent with other work, in that more massive galaxies have populations that are older, more metal enhanced and more strongly over-abundant in alpha elements than lower-mass systems.

Kroonenberg, with supervision from McDermid, conducted a study of ionized gas in the central regions of early-type galaxies, using a small

sample of objects taken from the SAURON survey. This project combined existing SAURON data of Hβ and [OIII] with new observations of the four galaxies using the OASIS spectrograph to obtain Hα and [NII]. Ratios of these emission lines were used as diagnostics of the ionization mechanism at work. Initial results show that three of the four objects are consistent with being LINERs. One object was found to exhibit a broad-line region that was previously suspected, but not conclusively detected. In this object, the emission becomes LINER-like away from the nucleus, showing that multiple mechanisms are responsible for ionizing the gas.

Falcón-Barroso supervised the research projects of José Luis Cervanted Rodríguez (a PhD student at the Instituto de Astrofísica de Canarias, visiting the Sterrewacht Leiden under the EARA program) and Silvia Toonen (a Masters student at the Sterrewacht Leiden on a 6-month research visit to the Instituto de Astrofísica de Canarias with Prof. John Beckman). The first project was dedicated to study the stellar populations of dwarf galaxies using OASIS integral-field spectroscopy, while the second one is still undergoing and has been designed to characterize the bar pattern speed and luminosity-velocity dispersion relation for the HII regions in the spiral galaxy NGC 6946, by means of Fabry-Perot Hα data.

2.7.12. The Atlas 3D Survey

McDermid, together with Emsellem (Lyon), Cappellari (Leiden/Oxford) and Krajnovic (Oxford), successfully obtained long-term status for the Atlas3D Survey: a new survey of early-type galaxies using the SAURON spectrograph on the WHT. The collaboration includes co-investigators de Zeeuw and Falcón-Barroso, as well as other Dutch and British collaborators. Over three semesters (18 months) this large program will observe all early-type galaxies within the local 40Mpc, and provide a complete census of galaxy kinematic morphology, angular-momentum, gas content and stellar populations over a broad range of galaxy mass and environment. This project builds on the success of the SAURON Survey, and aims to establish the detailed demographics of the local early-type galaxy population to establish the mechanisms of their formation and evolution. First observations will be made in early 2007, ending in Spring 2008, with first results appearing next year.

2.7.13. Supermassive Black Holes

McDermid and de Zeeuw, together with Gebhardt (Texas) an Richstone (Michigan), hosted a Lorentz workshop on the nuclei of galaxies, following the success of a similar meeting two years before. Recent progress from various groups was reported, including data from AO-assisted instruments SINFONI and OASIS, and work from the SAURON group. Progress was made on performing cross-comparisons between groups building dynamical models, with three groups including Leiden agreeing to compare black hole masses inferred from their dynamical models.

Work is ongoing by McDermid, Cappellari (Leiden/Oxford) and Krajnovic (Oxford) on using AO-assisted integral-field spectroscopy to derive accurate black hole masses in nearby early-type galaxies. The first data using the SINFONI spectrograph at the VLT was obtained and analysed, with initial results consistent with predictions from the well-known relation between black hole mass and velocity dispersion.

2.7.14. Dynamical Models and Analytic Methods

Van den Bosch, Cappellari and de Zeeuw, together with van de Ven (Princeton), continued 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 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.

Building on the analytic framework developed previously by van de Ven, van den Bosch lead the effort on describing this triaxial Schwarzschild code, as well as presenting an application of the software to the complex elliptical galaxy, NGC 4365. This galaxy is well known for its central kinematically decoupled component, and its apparently prolate outer body. It was shown that the software is able to reproduce the observed and intrinsic properties of an analytic triaxial model, including a convincing recovery of the

distribution function itself. The application to NGC 4365 revealed the surprising result that the galaxy is not (as may be assumed from the observed kinematics) simply an oblate core rotating in a prolate system, but in fact has a significant fraction of stars orbiting in extended, disk-like components, which, when viewed in projection, appear as a compact core embedded inside a prolate galaxy (see Figure 2.4).

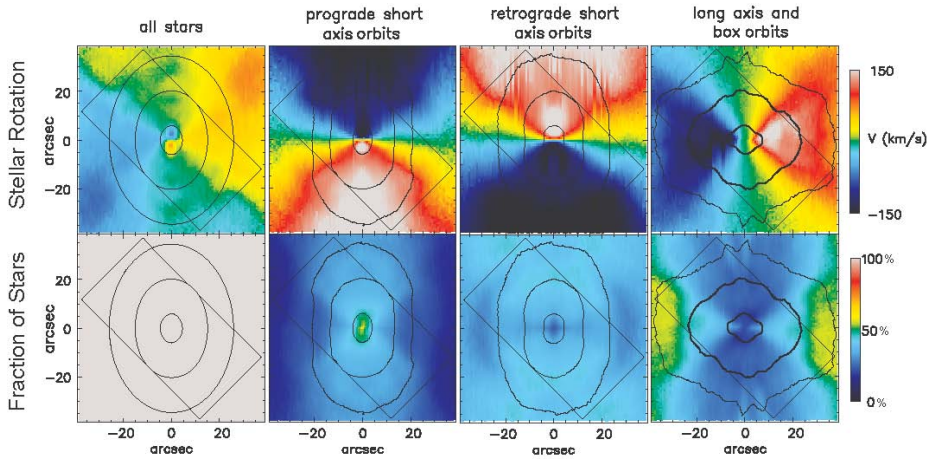

Figure 2.4. The top row shows stellar rotation velocity. The bottom row shows the fraction of the total number of stars contributing to the model at a given position. Contours indicate the projected surface brightness of the component associated to the velocity field, and the rectangular box indicates the region covered by the fitted SAURON observations. The left column shows the complete triaxial Schwarzschild model fitted to SAURON data of NGC 4365. This model reproduces well the central decoupled component and overall velocity structure of the galaxy. The next three columns show the major orbital components populated in the model, indicating also to which orbital family they belong. All three orbital components are extended across the whole galaxy, and surprisingly the short axis orbits contribute 60% of the mass (split almost equally between prograde and retrograde orbits), showing that the galaxy is more complex than simply a prolate main body harboring a small decoupled core.

2.8 High Redshift Galaxies

2.8.1. Faint Submillimeter Galaxies

A key result from the Ph.D. thesis of Knudsen (2004, now at MPIA) was the discovery of triply-lensed submillimetre galaxy at z=2.516, behind the cluster A2218. This galaxy is lensed by a factor of about 45, and would be too faint to detect without lensing. However, its properties are of interest since with its low intrinsic flux it is characteristic of the galaxies that make up the bulk of the submillimetre background. Hence several follow-up observations were carried out. Radio observations with the WSRT and the VLA were carried out by Garrett (JIVE) in collaboration with Van der Werf and Knudsen. All three images were detected, with an implied star formation rate of about 500 $M_{sun}yr^{-1}$ and no evolution in the infrared-radio relation out to z=2.5. The object was also observed in the CO(3–2) and CO(7–6) lines with the IRAM Plateau de Bure interferometer by Kneib (Marseille), incollaboration with Van der Werf and Knudsen. The velocity profile of the CO(3–2) line displays a double-peak profile which is well fit by two Gaussians with FWHM of 220 km s^{-1} and separated by 280 km s^{-1}. The implied dynamical mass is ~ 1.5 x 10^{10} M_{sun} and an H_2 gas mass of 4.5 x 10^9 M_{sun}. This system is much less luminous and massive than other high-redshift submillimetre galaxies studied to date, but it bears a close similarity to similarly luminous, dusty starburst resulting from lower-mass mergers in the local Universe.

2.8.2. The SCUBA-2 Cosmology Legacy Survey

Recognizing the enormous potential of SCUBA-2, the successor of the SCUBA 850μm camera at the JCMT, the JCMT Board has approved the concept of large-scale community-wide legacy surveys with the JCMT in the period from 2007. The most highly rated of these was the SCUBA-2 Cosmology Legacy Survey, with four Principal Investigators: Van der Werf (Leiden), Smail (Durham), Dunlop (Edinburgh) and Halpern (Vancouver). This survey, to be carried out from 2007 to 2009 will revolutionize submillimetre cosmology by mapping 15 square degrees to the confusion limit at 850 μm and 0.5 square degrees to the confusion limit at 450 μm. The time allocation was 1220 hours, including 490 hours of the best quality

weather. It is clear that a project of this magnitude could never have been achieved through the normal time allocation process.

2.8.3. Dynamics of High-redshift Galaxies

Van Starkenburg and Van der Werf continued their study of the kinematics of high redshift galaxies using rest-frame optical emission lines. They finished their analysis of a sample of z ~ 1.5 galaxies. A ~ 2 mag offset from the local *B* band Tully-Fisher relation was found, with considarably uncertainties due to ambiguities in velocity measurements and sample selection effects.

They also did their first observations with SINFONI (the new near-infrared integral field spectrograph of the VLT) and obtained a new sample for the study of the kinematics of high redshift galaxies. Targets were z ~ 0.8 galaxies selected to be very suited for kinematical studies. Much effort was invested in the accurate reconstruction of SINFONI's field of view.

2.8.4. Distant Radio Galaxies

Distant luminous radio galaxies are among the brightest known galaxies in the early Universe and the likely progenitors of dominant cluster galaxies. During 2006 Miley and Röttgering, Overzier and Intema at Leiden continued using these objects as probes of the early Universe, together with a large group of external collaborators.

A highlight of this work was the completion of Overzier's PhD thesis in May. Following a VLT Large Project on the environment of distant radio galaxies, Overzier's PhD thesis provided a detailed study of the protocluster environments of several z > 2 radio galaxies with the Advanced Camera for Surveys on the Hubble Space Telescope, including objects at redshifts z = 4.1 and z = 5.2. The overdensities are consistent with the presence of protoclusters around all the radio galaxies studied. The thesis relates the observations to general scenarios for the formation and evolution of galaxy clusters.

A second highlight was a spectacular deep image of the dominant galaxy in a protocluster at z ~ 2.2 taken with the ACS on Hubble. This showed more

than 10 clumpy features, apparently star-forming satellite galaxies in the process of merging with the progenitor of a dominant cluster galaxy, 11 Gyr ago. The new image is the best demonstration so far that massive galaxies assemble by merging of smaller objects in a hierarchical process. A striking feature of the newly named "Spiderweb Galaxy" is the presence of several faint linear galaxies within the merging structure. The dense environments and fast galaxy motions at the centers of protoclusters may stimulate the formation of these structures, which dominate the faint resolved galaxy populations in the Hubble Ultra Deep Field. The new image provides a unique testbed for simulations of forming dominant cluster galaxies.

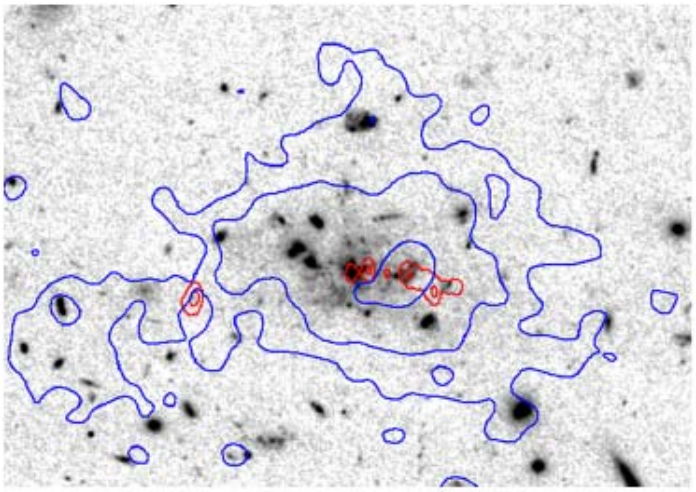

Figure.2.5 The Spiderweb Galaxy - a forming massive galaxy at the centre of a protocluster at z = 2.2. This ultra-deep image made with 19 orbits using the ACS on the Hubble Space Telescope demonstrates the importance of hierarchical merging processes in the formation and evolution of massive galaxies. The black clumps are satellite galaxies that are merging with the massive host galaxy – "flies" being captured by the spiderweb.

Contours of radio emission are shown in red and Ly α emission in blue. The Ly α ionized gas halo extends over a size of ~ 200 kpc and is one of the largest known objects in the Universe (Miley, Overzier et al. Astrophys. J. Letters, 650, L29 – 32, 2006).

2.8.5. Evolution of Radio Galaxies

Binette, (Instituto de Astronomía, Mexico), Röttgering and others, presented photoionization calculations for the spatially-extended absorbers observed in front of the extended emission-line spectrum of two high-redshift radio galaxies, 0943-242 (z_e =2.922) and 0200+015 (z_e =2.230), with the aim of reproducing the absorber column ratio, N_CIV/N_HI. They found that hot stars from a powerful starburst, or a metagalactic background radiation in which stars dominate quasars, are equally successful in reproducing the observed N_{CIV}/N_{HI}, assuming subsolar gas metallicities for each absorber.

Dannerbaumer (Heidelberg), Daddi (NOAO, Tucson). Röttgering and others carried out MAMBO 1.2 mm observations of five vigorous starburst galaxies at z~2 and detected two. They advocate a scenario in which z~2 galaxies, after their rapid (sub)millimeter-bright phase that isopaque to optical/UV light, evolve into a longer lasting phase of K-band-bright and massive objects.

Intema and collabotators presented broad-band imaging with the Subaru Telescope of a 25' × 25' field surrounding the radio galaxy TN J1338-1942 at redshift z = 4.1. The field contains excesses of Lyman-α emitters (LAEs) and Lyman break galaxies (LBGs) identified with a protocluster surrounding the radio galaxy.

There are 874 candidate LBGs within this field, having redshifts in the range z = 3.5-4.5. An examination of the brightest of these (with i' < 25.0) shows that the most prominent concentration coincides with the previously discovered protocluster.

Tasse, Röttgering, together with Cohen (NRL Washington) and coworkers, present the observational results of a low frequency radio survey of the XMM-LSS field using the Very Large Array at 74 and 325 MHz. This survey will map out the locations of the extragalactic radio sources relative to the large scale structure as traced by the X-ray emission. At 325 MHz we have detected a region of diffuse radio emission which is a cluster halo or relic candidate.

Valdés (Trieste, Italy), Ciardi (Munich, Germany), Ferrara (Trieste, Italy), Johnston-Hollitt (Hobart, Australia) and Röttgering used numerical simulations of cosmic reionization and radiative processes related to the HI

21-cm emission line to produce synthetic radio maps as seen by next-generation telescopes that will operate at low radio frequencies (e.g. the Low Frequency Array, LOFAR). Two different scenarios, in which the end of reionization occurs early (z~13) or late (z~ 8) depending on the initial mass function (IMF) of the first stars and ionizing photon escape fraction, have been explored. For each of these models we produce synthetic HI 21-cm emission maps by convolving the simulation outputs with the provisional LOFAR sampling function in the frequency range 76-140 MHz. If reionization occurs late, LOFAR will be able to detect individual HI structures on arcmin scales, emitting at a brightness temperature of ~35 mK as a 3σ signal in about 1000 h of observing time.

2.8.6. Galaxy Evolution

Franx and collaborators studied the evolution of galaxies from z=7 to z=0, based on a variety of search techniques. His work focusses on the properties 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.

Van Dokkum, Franx, and collaborators studied the properties of a mass selected sample at z=2-3 based on the MUSYC and FIRES surveys. They found that intrinsically red galaxies, previously dubbed 'DRGs' for Distant Red Galaxies, dominate the mass in galaxies at the massive end. Galaxies found as Lyman Break galaxies are abundant, but contribute less. Massive galaxies at z=2-3 have a wide range in properties.

Kriek, van Dokkum, Franx, and collaborators presented spectroscopy of massive galaxies at z ~ 2.3, and they found that a considerable fraction (45 %) show no emission lines, and hence no evidence for (strong) star formation. The sample is considered to be typical for high redshift, massive galaxies, and the results indicate that the star formation rate is very low for a considerable fraction of massive galaxies. The mechanism responsible for the down turn in star formation still needs to be identified.

The quiescent galaxies identified above are only part of the population: Webb, Franx, and collaborators studied the 24 μm fluxes of massive galaxies at z=2-3, as measured by the Spitzer Space Telescope. Many of the DRGs

identified in the field had strong fluxes, indicating high star formation rates. These galaxies contribute significantly to the overall star formation rate at redshifts z=2-3.

Bouwens, Illingworth, Franx, and Blakeslee analyzed the luminosity function of z=6 i-dropout galaxies in the fields with the deepest available Hubble Space Telescope ACS imaging. 506 candidates were found, and the luminosity function was determined. Significant evolution in the luminosity function was found at the bright end, between z=3 and z=6. The star formation rate density increases significantly between z=6 and z=3.

Labbé, Franx, and collaborators studied the mid-IR emission of z=7 galaxies, identified as z-dropout galaxies in the UDF. Two of the four candidates were unambiguously detected with Spitzer, and hence their reality was confirmed. Masses and ages were derived for these two galaxies.

Van der Wel, Franx, Wuyts, and collaborators compared dynamical masses of early-type galaxies out to z=1, with those obtained by fitting stellar population models to photometry. They found that stellar population models can work well when fitted to the rest-frame optical photometry, but that it does not work so well when fitted to rest-frame near-IR photometry. Uncertainties in the modeling of the late stages of stellar evolution can produce uncertainties in the obtained masses when the near-IR photometry is used.

2.9.Theoretical Studies

2.9.1. Supermassive Black Holes and Compact Objects

Levin works on astrophysics of supermassive black holes (focusing on the Galactic Center), and on astrophysics of neutron stars. The highlights for 2006 were:

1. Dynamics and star formation in the Galactic Center. Together with Beloborodov (Columbia) and MPE infrared group led by Reinhard Genyel, Levin has analyzed the properties of the 2 young star discs in the Galactic Center: Paumard, et al., 2006, ApJ, 643, 1011, Beloborodov, Levin, et al., ApJ, 648, 405.

The star discs were found to be confined to the central 1/2 parsec from the supermassive black hole. This has decisively argued for the scenario in which the young stars formed as a result of gravitational fragmentation of the massive accretion disc several million years ago, as was orogonally proposed by Levin and Beloborodov in 2003. Levin has also analyzed the ejection of high-velocity stars from the galactic center by a hypothetical Intermediate-Mass Black-hole (IMBH) companion to SgrA* (ApJ, 653, 1203). He found that the stars get ejected in a burst who's duration is comparable to the dynamical-friction timescale in the SgrA* stellar cusp, i.e. several million years. The clustering of the ejection times and directionality of the ejection velocities map out the history if the IMBH inspirals. Therefore, future observations of high-velocity stars are likely to constrain the presence of the IMBH in the center of our Galaxy.

2. Magnetar oscillations. Levin has begun to develop the theory of magnetar oscillations (MNRAS, 368, L35); the sequel to this work has been completed and published in 2007. Levin found that magnetar oscillation features reach dynamics due to interaction between the vibrational torsional modes of the magnetar's crust and the Alfven waves in the magnetar's core. This dynamics helps explain the Quasi-Periodic oscillations observed in the X-ray light curves during several hundred seconds after the magnetar giant flares. Levin's work offers a possibility of performing (albeit yet primitive) asteroseismology of magnetars. In particular, the observed oscillations strongly constrain the Alfven speed in the magnetar core.

2.9.2. Theory of Galaxy Formation

Simulating the formation and evolution of galaxies and the intergalactic medium

Dalla Vecchia, Duffy, Haas, Schaye, 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 Importance of Local Sources of Radiation for Quasar Absorption Line Systems

Schaye developed an analytic model for high column density quasar absorption line systems. Assuming that they arise in the halos of galaxies, the model can be used to predict the distribution of impact parameters, luminosities and flux from the central sources. He showed that local radiation, which is usually ignored, likely dominates over the ionizing background radiation for systems rarer than Lyman limit systems. For damped Lyman-alpha systems, the local radiation field has actually been measured and is in excellent agreement with the model. He also showed that consistency between observations of the UV background, the UV luminosity density from galaxies, and the number density of Lyman limit systems requires escape fractions of order 10 percent.

The Spatial Distribution of Metals in the Intergalactic Medium.

Schaye, together with Pieri (Laval University) and Aguirre (UC Santa Cruz), studied the spatial distribution of heavy elements in the intergalactic medium at redshift z~3. They carried out a detailed analysis of a high-quality Keck/HIRES absorption spectrum of the quasar Q1422+231 and found that within 600 km/s from strong C~IV absorbers, which are thought to arise in the halos of galaxies, the abundance of carbon and oxygen is significantly higher than for gas of the same density (i.e., with the same level

of H I absorption) but in a random location. However, if the analysis was restricted to the two thirds of the spectrum that are at least 600 km/s away from any C~IV line strong enough to detect ambiguously, the metal-line absorption was only slightly less strong than for the entire spectrum. This suggests that while the metallicity is enhanced in regions close to galaxies, the enrichment is likely to be much more widespread than their immediate surroundings.

2.10. Raymond & Beverly Sackler Laboratory

The research in the Sackler Laboratory for Astrophysics (SLA) at Leiden Observatory contributes to our understanding of astrochemistry by simulating inter- and circumstellar processes in state-of-the-art experiments under laboratory controlled conditions. The results are interpreted in terms of unambiguous physical-chemical models, providing input that is necessary to calibrate astrochemical models, and in addition the work supports or guides the analysis of observational data. The laboratory comprises six experiments focusing both on solid state astrochemistry – CRYOPAD, SURFRESIDE, CESSS and the HV-setup – and on the gas phase with a special emphasis on the 'radical universe' – SPIRAS and LEXUS. The experiments are performed in close collaboration with groups with expertise in observations, modeling and theoretical simulations.

In 2006 the group consisted of one senior scientist, Harold Linnartz, two postdocs, Guido Fuchs and Herma Cuppen, six PhD students, Suzanne Bisschop, Sergio Ioppolo, Karin Öberg, Nadine Wehres, Harald Verbraak, Jordy Bouwman, and two Greenberg Fellows, Kinsuk Acharyya (India) and Zainab Awad (Egypt). The laboratory hosted Wiebke Ludwig as an undergraduate student. Much of the research was done in close collaboration with the in-house astrochemistry group of Ewine van Dishoeck, who co-supervises several SLA PhD students and who is actively involved in the ice projects.

A video tour through the laboratory with details on the experiments is available from the homepage: http://www.strw.leidenuniv.nl/~lab.

2.10.1. CRYOPAD – CRYOgenic Photo-product Analysis Device

CRYOPAD routinely achieves ultra-high vacuum (UHV) conditions (~ 5.10^{-11} mbar) in which interstellar ice analogs are grown with mono-layer precision at temperatures as low as 14K. Sensitive detection techniques such as temperature programmed desorption (TPD) and reflection absorption infrared spectroscopy (RAIRS) are used to study both spectroscopic and thermal properties of pure, layered and mixed ices upon thermal- and photoprocessing.

A series of detailed experiments on the desorption behaviour of CO and CO/O_2 ices by Fuchs and Acharyya have shown that the low molecular oxygen abundances in space cannot be explained by a simple freeze out of O_2 on interstellar grains. The thermal properties of pure O_2 and CO ices are remarkably close and this means that the observation of substantial amounts of gaseous CO excludes large amounts of frozen O_2. The results have been interpreted in terms of an empirical kinetic model that provides binding energies and temperature dependent sticking probabilities for different ice morphologies.

A long standing problem in interstellar chemistry is how molecules can be maintained in the gas phase at the extremely low temperatures in space. In very cold (< 10K) star and planet forming regions all molecules other than H_2 should stick on dust grains on timescales shorter than the cloud lifetimes, yet these clouds are detected in the radio lines of gaseous CO. Several desorption mechanisms have been proposed, but there is a general lack of quantitative experimental data on such processes. Öberg and Awad have initiated the first laboratory study under ultra-high vacuum conditions of the photodesorption of pure CO ice and found that for a typical interstellar radiation field (7-10.5 eV) the photodesorption rate amounts to as much as 3.10^{-3} molecules per VUV photon. This results shows that the role of CO photodesorption in preventing total removal of molecules in the gas phase has been strongly underestimated.

2.10.2. SURFRESIDE – SURFace Reaction Simulation Device

SURFRESIDE is another UHV setup in which TPD and RAIRS are used to monitor reaction products formed in interstellar ices following atom-molecule reactions. Fuchs, Bisschop and Ioppolo focused on hydrogenation reactions and were able to prove that both formaldehyde and methanol are formed upon H-atom bombardment of CO-ice via the reaction scheme CO → H_2CO → CH_3OH. The experiments unambiguously show that interstellar ices are involved in the formation of the more complex (saturated) species. Accurate rate constants have been derived in dependence of a number of physical parameters (ice morphology, thickness, temperature, atom-flux, etc.) and the analysis of hydrogenation reactions starting from other ices (e.g. CO_2) is presently in progress.

In order to study also reactions with O-, N- and C-atoms a second atom beam line has been designed in close collaboration with the ELD/FMD. This line will be implemented in the course of 2007. The simultaneous bombardment of interstellar ices with both H- and other atoms provides a unique facility and will show to which extend catalytic reactions in interstellar ices on dust grains play a role in the chemical evolution of the universe.

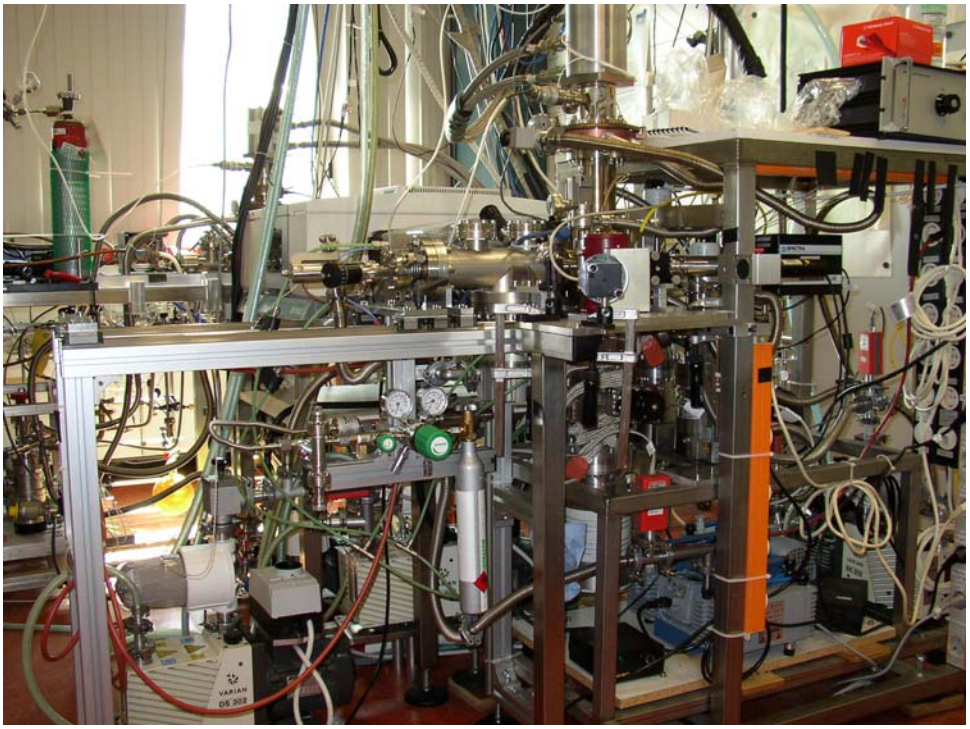

Figure 2.6: SURFRESIDE II. A recently constructed setup to study chemical reactions in interstellar ices on grain dust equivalents. In 2006 a number of hydrogenation reactions have been characterized that open the new field of solid state astrochemistry.

2.10.3. CESSS – Cavity Enhanced Solid State Spectrometer

In 2006 CESSS has been fully assembled by Bouwman and the system is operational now. CESSS is a sensitive spectroscopic setup in which ices are grown under high vacuum conditions and monitored using broad band cavity enhanced absorption spectroscopy. The technique extends interstellar ice research from the infrared into the UV/VIS/NIR part of the electromagnetic spectrum. The first test measurements show that the detection of gas phase transitions in the highly reflection part of the cavity

mirrors – covering typically 50–100 nm – is straight forward. The setup allows sensitive spectroscopy over a large spectral range (200-1200 nm) with a resolution of the order of 0.1 nm.

2.10.4. HV-Setup

Öberg, Bisschop, Awad, Bouwman and Ludwig used the HV-setup to systematically study the infrared spectral properties of a number of astrophysically relevant ice mixtures. Using Fourier transform infrared spectroscopy the fundamental vibrational modes of a number of binary and tertiary mixtures have been studied in transmission as function of ice composition and ice temperature. Detailed results have been obtained for H_2O:CO_2 and H_2O:CO ices that have been used to understand why astronomical observations of water ice result in deviating intensity ratios of the H_2O fundamentals. A comparison with the results found for mixtures containing N_2 and O_2 provides a physical-chemical basis that explains changes in band profiles, frequency shifts and intensity strengths. Furthermore, HCOOH ices have been studied in mixtures with CH_3OH, CO, CO_2 and H_2O – species that are most likely involved in the formation process of formic acied - and it was shown that tertiary mixtures may very well explain astronomical data as observed by ISO and Spitzer.

2.10.5. SPIRAS – Supersonic Plasma InfraRed Absorption Spectrometer

Many gas phase species observed in inter- and circumstellar matter are open shell species, reflecting the radical character of the universe. SPIRAS, operated by Verbraak, offers the unique possibility to study such species at high resolution (< 100 MHz) in the infrared (3-10 μm) by combining production modulation in a phase-sensitive detection scheme and supersonically expanding planar plasma. The setup has been successfully used to study molecular complexes in order to spectroscopically characterize charge induced interactions. In collaboration with the University of Zürich a systematic mass spectrometric study of cluster-ions (of potential astrophysical interest) has been performed.

In close collaboration with the Department for Molecular- and Laser Physics (Radboud University Nijmegen) a special OPO laser system has been implemented. Continuous cavity ring down spectroscopy has been used to study molecular ions of astrophysical interest in direct absorption. The experiments show that densities of the order of 10^{10}-10^{11} rotationally cold ions/cm^3 are routinely produced in the plasma and that densities of the order of 10^8-10^9 ions/cm^3 are still detectable. Rovibrational transitions are monitored with absolute frequency accuracy better than 0.001 cm^{-1}.

2.10.6. LEXUS – Laser Excitation Setup of Unstable Species

Wehres incorporated in the initial setup a special plasma source that is capable of producing an intense hydrocarbon plasma. LEXUS is capable of observing small amounts of gas after laser excitation using time gated fluorescence spectroscopy. Test measurements on NO_2 have been very successful and show that the basic setup is fully operational. The extension with the plasma source makes it possible to look for astrophysically relevant radicals in emission. This experiment is performed in close collaboration with Profs. Tielens / Spaans (Kapteyn Institute Groningen) and van Winckel (University Leuven) and aims at identifying molecular carriers as observed on top of the extended red emission in the Red Rectangle.

2.10.7. Monte Carlo simulations of Astrophysical Processes

Cuppen has started her VENI position on 'Monte Carlo simulation of ice mantles' on October 1st. In support of the laboratory work calculations have been performed to simulate the thermal desorption behavior of interstellar ice analogues as well as to derive chemical reactivity. A new concept of continuous-time, random-walk Monte Carlo simulations is used. The method is unique in the way that it allows simulations for time periods that extend far beyond what is possible in the laboratory. The focus has been on H_2 and H_2O formation.

2.11 Instrumentation

2.11.1. ALMA Regional Center Node

The user support for ALMA in Europe (ALMA Regional Center, ARC) is organized through a distributed network of seven nodes: one central node at ESO taking care of core functionalities, and six nodes throughout Europe focussing on face-to-face user support as well as specific expertise areas. With support from NOVA, the Netherlands is setting up one of these nodes located at Leiden Observatory. Hogerheijde is coordinating the activities, with help from Hill and Van der Tak (SRON Groningen). The activities are overseen by a steering committee consisting of members of NOVA, SRON, ASTRON, and JIVE. In 2006 Hill focused on an inventory of exisiting software for the calibration and reduction of (sub)millimeter-wave interferometric observations, with a special emphasis on the interoperability of variou spackages. A web site describing the Netherlands node of the ARC was set up by Hill and accessible from the pages of Leiden Observatory.

2.11.2. 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. The Gaia mission was fully approved by ESA's science programme committee in early 2006 following the selection of EADS-Astrium as the prime contractor for the design and building of the spacecraft and payload. The EADS-Astrium design for Gaia contained significant changes with respect to the previous baseline, especially for the photometric instrument, which now uses low dispersion spectrophotometry with prisms instead of photometric filters. As a consequence in 2006 a lot of effort went into the optimization of the new design and the rethinking of the photometric data processing. The main activities for 2006 were:

1) Brown and Marrese developed detailed simulations of the data obtained with the new photometric instrument. These were used in the optimization of the wavelength range and dispersion of the blue and red

channel of the photometric instrument. The simulations have now been incorporated into the Gaia project-wide simulation environment which will be used to generate simulated mission data to support the development of the data processing methods and algorithms.

2) Marrese performed a detailed study of the consequences of the new design for the data collection in crowded regions on the sky. The results were included in the optimization of the on-board data handling algorithms for Gaia.

3) Brown put together a detailed overview of the many complications that can be expected when processing (possibly overlapping) dispersed images collected in time-delayed integration mode. This overview forms the basis for the further development of the data processing algorithms for the new photometric instrument of Gaia.

4) Within the Gaia project the Data Analysis Coordination Committee (DACC) was set up which is tasked with defining and putting into place the Gaia Data Processing and Analysis Consortium (DPAC). The work of the DACC was finished by mid-2006 after which the DPAC was constituted. The consortium consist of about 250 members throughout Europe. The DPAC responded to ESA's announcement of opportunity for the data processing by submitting a large proposal in December 2006. Brown was involved in the writing thereof. The DPAC is expected to be formally recognized by ESA by mid-2007.

2.11.3. 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. After its positive review and subsequent approval by ESO in 2004, MUSE entered its Preliminary Design Phase with its Kick-off meeting in January 2005. 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 calibration of MUSE - and the MUSE science team. MUSE is currently preparing for its Preliminary Design Review.

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 Hallibert, Stuik and Vink, passed it Optical Preliminary Design review by ESO in October 2006. Further interactions with the ESO AOF team has led to further improvements in the design of ASSIST and cleared the way to a more simplified design.

2.11.4. LOFAR

The LOFAR project has made significant progress. The first LOFAR core station (CS1) was constructed in the fields of Exloo during the summer of 2006. 96 low band antennas have been distributed over 4 station locations; 48 antennas were placed in a central field and the remaining was distributed over 3 stations yielding a variety of baselines of up to 450 metres. The set-up was chosen to enable performance tests of a single station at full bandwidth and to emulate a small test version of a LOFAR-type interferometer with 24 micro-stations at reduced bandwidth. The LOFAR prototype station CS1 started operations at the beginning of October 2006. After 3 month of hard work, the entire imaging pipeline had all its main software elements in place. Beams are formed at the station level and transported to the Bluegene correlator through an optical fiber network and subsequently visibilities were produced.

With the arrivals of Amitesh Omar, Oleksandr Usov and Ilse van Bemmel early October, the Leiden survey group has now reached a certain critical mass. Although Ilse van Bemmel formally works for the SKA project, the work she is doing to understand the calibratebility of the SKA telescope is directly applicable to LOFAR. With a working version of the BDSM, the new software package to find and characterise radio sources, our efforts for the imaging pipeline are progressing well. A large WSRT proposal was accepted to do a deep and wide survey at 1400 MHz of several famous survey fields. The first data was taken at the end of 2006 and was of high quality. A similar proposal was submitted to the GMRT to survey similar sized regions at 610MHz. Apart from the scientific aims, a major goal of these surveys is to test whether our pipeline is able to handle large image data sets.

Huib Intema continued his work on implementation of a scheme to correct for ionospheric phase disturbances on low frequency radio data. This scheme is a simplified version of the LOFAR Calibration framework (Noordam 2006), implemented using ParselTongue, the Python interface to classical AIPS. From a GMRT 150 MHz data set on Abell 2256, he made movies to compare the effects of different phase calibration techniques.

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 2006 focussed on two themes. The first one was the foundation of the Association Internationale du Froid (International Association of Refrigeration) in the period 1908-1909. A publication will appear in the journal Centaurus. The second topic was the history of the Leiden Kamerlingh Onnes Laboratory during World War II.

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 2006, 24 freshmen started their studies in astronomy, and 12 students started their second bachelor year. The total number of students registered at the Observatory was 89, including Bachelors, Masters, and old-style doctoral students. Several students from Delft Technical University (from the applied physics and aerospace departments) took courses of the Leiden astronomy curriculum as part of the requirements for a minor in astronomy.

A major effort was mounted (Israel) to collect a variety of information for inclusion in the socalled 'Self-Evaluation Report', produced by the Faculty of Mathematics and Sciences in preparation of the site visit by the committee charged with the evaluation of all aspects of education within the Faculty. This visit, originally planned for October, was postponed to January 2007 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. Kuijken was study adviser

for the remainder of the Bachelor programme. Röttgering took over as master programme study advisor from Le Poole, starting October 1. 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 member (Schaye and Linnartz) and senior student mentors. As the evaluation of the first year of freshman student tutoring by senior students (Hoogeboom, van Uitert, Brill, van de Voort and Siero) was very positive, it was decided to continue this activity on a regular basis. 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 on October 6 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, eleven honors 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 end of the year, there were 19 master students, nine of them from outside The Netherlands. In 2006, 11 students began their master study, whereas two obtained their degree. Starting this year, each master student now has his or her individually tailored study plan.

The astronomy curriculum is monitored by the 'Opleidingscommissie' (education committee), which advises the Director of Education on all relevant matters. Katgert resigned the chair by the summer, and was replaced by Van der Werf. Other members are Icke, Schaye, Intema and Damen, as well as Toonen (replaced by van Riet for most of the year), de Valk, van den Broek, Straatman and Langelaan for the student body. Under the authority of the Opleidingscomissie, a lecture course monitoring system (SRS) was started, in which designated students provide feedback to lecturers during and after the course.

The quality of curriculum and exams is guarded by the 'Examencommissie' (Exam Committee) where Lub took the chair from Israel, who remained member of the committee, as well as Groenen (physics), Hogerheijde and Van der Werf.

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 2006

3.2.1. Ph.D. degrees

A total of five graduate students successfully defended their Ph.D. theses in 2006 and were duly awarded their Ph. D. degree: They are:

Inge L. ten Kate	January 26
Titel thesis:	*Organics on Mars*
Thesis advisor	Pascale Ehrenfreund
Roderick Overzier	May 30
Titel thesis:	*Emergence of cosmic structures around distant radio galaxies and quasars*
Thesis advisor	George Miley
Bastiaan J. Jonkheid	June 28
Titel thesis:	*Chemistry in Evolving Protoplanetary Disks*
Thesis advisor	Ewine van Dishoeck
Sijme-Jan Paardekoper	September 28
Titel thesis:	*Growing and Moving Planets in Disks*
Thesis advisor	Vincent Icke
Rowin Meijerink	November 8
Titel thesis:	*Models of the ISM in Galaxy Centers*
Thesis advisor	Frank Israel

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

The following 14 students were awarded Master's/Doctoral degrees in 2006:

Name	Date	Present Position
Marieke van Duin	Jan 31	NWO
Rogier Ensing	Feb 28	TNO
Franco Maschietto	Feb 28	Ph.D. candidate, Leiden Observatory
Guido Kosters	May 30	ESTEC
Sirach Franssen	Jun 27	Teacher Grammar School
Demerese Salter *	Jun 27	Ph.D. candidate, Leiden Observatory
Chaparro Molano *	Aug 29	onbekend
Stefan van Dongen	Aug 29	Software company
Eveline Helder	Aug 29	Ph.D candidate, Utrecht Observatory
Jan-Pieter Paardekooper	Aug 29	Ph.D. candidate, Leiden Observatory
Sebastiaan Veijgen	Aug 29	Computer staff member, Airport Schiphol
Paul Verburg	Aug 29	onbekend
Dave van Eijck	Oct 31	onbekend
Evelyn de Wachter	Oct 31	Ph.D. candidate, Universität Wien

* naar MSc curriculum

3.2.3. Bachelor's degrees

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

Name	Date
Floor Jan Roduner	Feb 24
Silvia Toonen	Feb 24
Caroline Bovée	Aug 25
Annemarie Hagenaars	Aug 25
Jasper H.J. Lukkezen	Aug 25
Hester Schouten	Aug 25
Maarten Zwetsloot	Aug 25
Louk Rademaker	Sep 29
Bas Nefs	Dec 20

3.3 Courses and teaching

3.3.1. Courses tought by Observatory staff curriculum 2006 - 2007

Elementary courses:

Semester	Course title	Teacher
1	Introduction astrophysics	K. Kuijken
2	Astronomy lab 1	P.P. van der Werf
3	Stars	J. Lub
3	Modern astronomical research	B. Brandl
4	Astronomy lab 2	I. Snellen
4	Galaxies and cosmology	M. Franx
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	J. Lub

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

Formation of Stars and Planets	E.F. van Dishoeck
Active galaxy nuclei	H.J.A. Röttgering
Cosmology	V. Icke
Radio astronomy and techniques	R.T. Schilizzi
Interferometry (interacademial lecture course)	
Astronomical Spectroscopy	H.V.J. Linnartz

Pre University Program

The Pre University College is a Leiden University program aimed to introduce talented 5th and 6th grade high-school students to university studies. It includes courses in several disciplines within the university, including astronomy. During 2006 eight students participated in the astronomy program. This was given by Miley and Snellen. The course concentrated on radio astronomy and on the new LOFAR radio telescope presently being built in the north of the Netherlands. The course consisted of 3 half-day sessions with lectures and practical work and a whole day excursion to the Westerbork radio telescope and the Research and Development Department of the ASTRON Foundation at Dwingeloo. Subsequently, the students prepared and delivered a presentation on LOFAR.

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 and in 2006/2007 twenty-seven.

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:

Israel gave, for the last time, his annual lecture course 'Astronomy' at Delft Technical University, for about 50 students in the departments of aerospace and applied physics.

Icke and Van Ruitenbeek (Physics) organized an interdisciplinary course 'Living Universe' first-year students, concerning life in the universe. Several Sterrewacht staff (van Dishoeck, Icke, Israel) lectured in this series.

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. Public Lectures and Media Interviews

Bisschop
'Astrochemie van Waarnemingen to experimenten' (Public lecture: Weer- en Sterrenkundige Kring Zaanstreek, Jan 26)
Idem (Public lecture: Stichting Weer- en Sterrenkunde Eemsmond, May 24)

Brown
'Gaia - Een stereoscopische kaart van de Melkweg' (KNVWS Heerlen; Feb 18)
'Gaia - Een stereoscopische kaart van de Melkweg' (KNVWS Enschede; Mar 14)
'Gaia - Een stereoscopische kaart van de Melkweg' (KNVWS 's Hertogenbosch; Oct 18)

Cuppen
'Grillige stofdeeltjes als katalysator van ruimte-ijs' (Nieuwsbrief Universiteit Leiden; Oct 24)
'Veel wetenschappers dansen de Argentijnse Tango' (interview in Carp* magazine, Nov 1)

Damen
'*Sterrenstelsels in het verre heelal'* (Public lecture KNVWS Delft; Jan 17)
'*idem'* (Public lecture KNVWS Almere; Jan 24)

van Delft
'*Nobele hoofden: de big science van Heike Kamerlingh Onnes'* (Ministerie van OCenW, Jan 18, Den Haag)
'*Dat mag in de krant'* (gastcollege Academische Jaarprijs, Apr 20, Eindhoven)
'*Idem'* (college in de serie Wetenschap en Samenleving, Sep 29, Leiden).
'*Science in the Newspaper'* (aio-school statistische fysica van de gecondenseerde materie, May 18, Driebergen)
'*Beelden van bèta's: Faust, Frankenstein, nerd'* (Eurekalezing op de NWO-manifestatie 'Bessensap', May 23, Amsterdam)
'Wetenschap in de krant' (gastcollege in het kader van de cursus wetenschapscommunicatie van Jos van den Broek, Sep 12, Leiden)
'Willem de Sitter en Albert Einstein over kosmologie' (lunchlezing Leidsche Flesch, Dec 6, Leiden).
'*Fit to print: science in the newspaper'* (fysisch colloquium Radboud Universiteit, Dec 12, Nijmegen).

van Dishoeck
'*Van moleculen tot planeten'* (Avondlezing, IMM Symposium, Nijmegen, May 1)
'Water in het Heelal'(NVWS Symposium, Utrecht, Oct 7)
'*Succes is een medaille met twee zijden'* (Gebraden duiven vliegen niet, Universiteit Leiden, p.70-71)
'*Interviewreeks Spinozapremie Laureaten'* (Universiteit Twente, www.Natuurkunde.nl)
'Kraamkamers aan de hemel' (Interview NRC, 4 jun)
'*Origin of life'* (Nobel Symposium 133 press release, Södertuna Swedish newspaper, Jun 12)

Haas
'*Stervorming 'in clusters*' (JWG; several times)
'*Sterrenstelsels'* (JWG; several times')
'*Botsende sterrenstelsels'* (JWG Jongerenkamp; July)
'*Kosmologie en de vorming van structuur in het heelal'* (JWG; Dec 29)

'*Afstanden in het heelal'* (JWG; Aug 15)
'Een maximale massa voor sterrenhopen?' (JWG; Aug 18)
'De VLT en de toekomst' (KNVWS Wega, Tilburg; Jan 14)
Tours through public observatory Sonnenborgh, (Utrecht; several times)
Symposium *'Planeten'* (JWG; Feb 11)
Astronomical youth holiday *'Sirenekamp'* (Aug 12-20)

Hekker
Teaching IMC weekend school (3x)
Kaiser lecture Exo-planets (Leiden, May 25)
Idem Kaiser price awared (Leiden, Sep 23)

Hogerheijde
'De vorming van sterren en planeten' (gastles VWO; Jan 19)
'Idem' (Feb 10)
'Idem' (Apr 20)
'Idem' (May 24)
'Waarnemingen van de vorming van sterren en planeten' (publiekslezing, Mar 8)
'Idem' (Nov 28)

Hopman
'Raadselachtige zwarte gaten' (nieuwsbrief Leiden, 21 nov)

Icke
'*Eenzame opsluiting'* (concertgebouw *Tijdgenoten* inleiding, Jan 23)
'*Symmetry*' (Leidsche Flesch interview, Jan 26)
'*Op de achterkant van een oude envelop'* (Verwijs Den Haag, Jan 28)
'*Zwarte gaten interview*' (Debbie van der Plas, Jan 30)
'*Interview quantummechanica'* (Simon Vroegop, Feb 10)
'*Interview Pre-University College'* (Feb 13)
'*Kosmologie en leven'* (HOVO Ollongren, Feb 14)
'*Homo Universalis'* (Brussel, Feb 16)
'*Op de achterkant van een oude envelop'* (Boekh. Donner Rotterdam, Mar 12)
'*Op de achterkant van een oude envelop',* (Van Liere Eindhoven, Mar 14)
'*Niks relatief*' (Mougins, Werner Kerbosch, Mar 16)
Comenius: '*Oerknal en deeltjes*', (Kerckebosch Zeist, Mar 17)

Weekendschool Zuidoost (Mar 19)
'*Donkere materie: ons kind en het Heelal*' (Kohnstamm Lezing, Amsterdam, Mar 24)
Weekendschool West, (Apr 2)
Interview AD over Huygens (JH Bakker, Apr 6)
Interview Leven! Magazine (B. de Haas, Apr 7)
'*Blunders*' (Vraaggesprek Teleac Hoe?Zo!, Apr 10)
'*Leven in het Heelal*' (ANW interview, Van den Hoven, Apr 11)
'*Bevroren ganzeveer*' (Hofwijck, Christiaan Lezing, Apr 13)
'*Alle kunde is sterrenkunde*' (College Open Dag Faculteit; Apr 21)
'*Antropisch principe*' (Interview Sjoerd & Iris (scholieren), Apr 25)
'*Christiaan Huytgens, il Galileo Olandese*' (Linde College, Oude Sterrewacht Mei 16)
Telef. interview Florine Koning (Jun 19)
Marathon Interview VPRO, DeSmet (Jul 4)
Interview Nolet (Aug 23)
'The next five years of radiation hydrodynamics' (Sterrewachtdag, Sep 7)
'*Precisie-kosmologie*' (Volkssterrewacht Copernicus, Overveen, Sep 27)
'*Verlichtingen*' (Afscheid leraar Berger, Almelo, Oct 6)
'*Energie*' (Wetenschapsdag, Oct 22)
'*Niks relatief*' (PTA/Nemo, "Vliegende Hollanders", Nov 15)
'*Relativiteit vanaf Huygens tot voorbij Einstein*' (Volksuniversiteit Haarlem, Nov 15)
'*Het Heelal als leermeester*' (Comenius, Warnsborn (Arnhem), Nov 17)
'*Huygens, de Nederlandse Galilei*' (Cleveringa Lezing, Haarlem, Nov 22
'*De geschminkte wetenschapper*' (VSenV/FLA, Dec 15)
'*The sound of stars*' (Kon.Conservatorium, Dec 19)

Israel
'*Manen en ringen van Pluto*' (Hoezo? Teleac Radio; Feb 23)
'Mars' (Space Expo, Noordwijk; May 21)
'*Alumnilezing Leidsche Flesch*' (Leiden; Jun 23)
'*Stumbling through the Universe*' (ESTEC, Noordwijk; Oct 26)
'*Pluto en de 7 dwergen*' (Leidsche Flesch, Leiden; Nov 3)
'*Stof van Komeet Wild*' (Teleac Radio 5; Dec 15)

Katgert
'Terugkijken naar de Oerknal' (Chr. Gymnasium Utrecht; Mar 3)
'Idem' (Schravelant College Schiedam; Apr 13)
'Het Uitdijend Heelal' (College Het Loo Voorburg; Mar 13)

Kuijken
Teleac Kettingvraag (Radio; Apr 7)
Interview BNR Nieuwsradio (Radio; Aug 23)

Linnartz
Observatory representative press releases. Press releases 2006:
- *Honderden jonge sterrenstelsels aan de rand van het heelal ontdekt*
- *Stoelendans van planeten*
- *Stellaire geboortebeperking in het jonge heelal*
- *Leidse bevolking stemt over lot Pluto*
- *Bewustwording heelal brengt kinderen verder*
- *Spiderweb galaxy slokt melkwegstelsels op*
- *Studenten onderzoeken planeetvorming in vallend vliegtuig*
- *Galactische radiatoren bepalen eigenschappen van sterrenstelsels*

Lommen
'Powers of Ten/Machten van tien' (popular talk at Old Observatory; Apr 12)
'Idem' (popular talk at Old Observatory; May 16)
'Dying stars/Stervende sterren' (popular talk at Old Observatory; Apr 26)
'Afstanden in de sterrenkunde' (popular talk during Open Day; November 24)

Miley
'LOFAR' (Leids Natuurkundig Gezelschap; Nov 18)
'LOFAR' (Avro Network Television; Oct 23)

Molster
Live interview, Wereld omroep (Oct 24)
Live interview, Radio 2 Ontbijtradio (Oct 26)
Interview NOVA Online News (Oct 28)

Ollongren

'Leven in het Heelal' (course, Snellius Building, Leiden, feb–apr 2006)
University (Hoger Onderwijs voor Ouderen)
Soeterbeeck Programma *'Het Onbegrensde Intellect'* (Radboud Universiteit Nijmegen):
*'Astrobiologie'*14 nov, Tilburg;
'Idem' 16 nov, Zwolle;
'Idem' 22 nov, 's-Hertogenbosch

Röttgering

'*Van de Big Bang tot het leven in het heelal'* (Cleveringa Lezing, Leeuwarden, Nov 26)

Salter
'*Experimenteren in de ultieme achtbaan: Leidse studenten verliezen tijdelijk hun gewicht'* (Interview Leidsch Dagblad, Newspaper; Mar 9)
'*Sterrenkunde Studeren: Zweverige wetenschap'* (Interview NOVA Online Astronomy Promotional Video, released Sept 12)
'*Studenten onderzoeken planeetvorming in vallend vliegtuig'* (Press Release SRON/NOVA, Oct 23)
'Ontdek planeetvorming in 20 seconden' (Press Release Leiden University, Oct 24)
'*Parabolic flight video footage'* (News item TV Noord, Oct 30)

Schaye
'Onze Melkweg en Andere Sterrenstelsels' (lecture Volksuniversiteit Eindhoven; April 27)
'Licht op intergalactische wolken' (WETENSCHAP - Mare 33, 15 juni 2006, artikel geschreven door journalist B. Braun)
Interview Hoezo Radio (Radio; Oct 6)

Smit

'Licht van Gewicht: Gravitationele Lenzen en Donkere Materie' (Popular Lecture KNWVS Amsterdam; Oct 24)
'Idem' (Popular Lecture KNWVS Leiden; Nov 14)

Snijders

'*De geboorte van een ster'* (Kaiser, public lecture; Jan 25)
'Machten van tien' (lecture Rotary; Jan 31)
'Idem' (lecture IMC weekendschool; March 19)
'Idem' (lecture Vrije School; March 20)
'Idem' (lecture; July 9)
'Extreme stervorming in starburst stelsels' (lecture LWSK; Feb 21)
'Idem' (lecture VWS Noord-Drenthe; Sept 8)
'Reis door het zonnestelsel' (lecture IMC weekendschool; March 12)
'Gevaren in de ruimte' (lecture IMC weekendschool; March 26)
'Botsende sterrenstelsels' (lecture JWG; July 30)

Vermaas
'*Gebruik je energie in de sterrenkunde'* (Wetenweek Lecture, Sterrewacht Almere; Oct 24)

Visser
'Astrochemie: Van interstellaire stofwolken tot leven' (Publieks-sterrenwacht Schothorst, Amersfoort; Apr 12)

Weijmans
'Donkere materie' (KNVWS Overveen; Jan 19)
'Idem' (KNVWS Midden-Limburg; Jan 22)
'Idem' (KNVWS Amersfoort; Oct 18)
'Idem' (KNVWS Den Haag; Oct 20)
'Idem' (KNVWS Oostzaan; Nov 30)
'Idem' (KNVWS Eindhoven; Dec 14)
'Dood van een ster' (Kinderlezing L.A.D. Kaiser; Feb 16)
'Idem' (Gastles Corbuloschool, Zoeterwoude; May 22)
'Wat doet een sterrenkundige?' (Gastles Da Vinci College, Leiden; Mar 14)
'Sterrenstelsels' (JWG, Leiden; Sep 24)

'Idem' (A.S.V. Prometheus, Leiden; Nov 29)
'Nabije Melkwegstelsels' (KNVWS Zuid-Limburg; Dec 9)

van der Werf

'Generaasjes' (Interview Omrop Fryslan; TV; Jan)

Wuyts
'*Tot de Grenzen van het Heelal'* (Public Lecture KNVWS 't Gooi; Sep 15)
'Idem' (Public Lecture Sterrewacht Vesta Zaandam; Mar 30)

de Zeeuw
'*De Sterrewacht'* (Reunisten Visser 't Hooft Lyceum, Jun 17)

3.5 The Leidsch Astronomisch Dispuut 'F. Kaiser'

Looking back over the activities Kaiser organized in the year 2006, it seemed as if providing drinks and food for its members were the core business of our Dispuut. The Dispuut organized a new years drink, a movie night (with foods and drinks), a dinner for members, a beginning of the academic year drink and a drink when the board changed. However, the year 2006 was also marked by - as of yet - the last series of public lectures and the winning of the Kaiser award for the organization of these public lectures.

These lectures were given by PhD students from the observatory. Leonie Snijders was the first to give a very successful lecture on the live of stars aimed at a very young audience. In total 110 people came to the old observatory to see Snijders' talk and visit the telescopes. A month later, Anne-Marie Weijmans gave a follow-up talk, for a somewhat older audience. The next talk had the title "Black Holes: Nature's Biggest Monsters" and was presented by David Raban. Dave Lommen followed up with a more advanced talk on dying stars. The last talk was by Saskia Hekkers, who talked about exo-planets. We are glad we had such excellent speakers which managed to attract and entertain large audiences. The

climax of this series came in september 2006. The entire Kaiser board was awarded the Kaiser price for organizing these talks.

As the new academic year started, the Kaiser board decided to change course. With a rapidly decreasing number of members, it was decided to do no more talks, no more tours but rather revert to the roots: the students. As such, talks for the students were organised, in addition to drinks, movie nights and an observing night (which had to be cancelled).

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 145 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 Leiden and involved among others a visit of the Thysiana Library. At the meeting, the 'Kaiserprijs' was awarded to the astronomy-student association L.A.D. 'F. Kaiser' for the successful organisation of an astronomy popularization event. VO-S members also received a newsletter with Sterrewacht news and were offered an electronic member dictionary.

Appendix I

Observatory staff December 31,2006

Sterrewacht Leiden

Observatory staff
December 31, 2006

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
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)
R.P.W. Visser	(UU(0.5)/UL(0.5), Teyler's Professor)

Associate Professors and Assistant Professors / Tenured Staff

B.R. Brandl	H. Linnartz
A. Brown	J. Lub
D. van Delft (0.0) *	R.S. Le Poole
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
Y. Levin	P.P. van der Werf

NOVA office

P.T. de Zeeuw	director
W.H.W.M.Boland	adjunct director
T. Brouwer	financial controller (0.2)
K. Groen	management assistant

Management Support and Secretaries

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

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 (J.H. Oort Foundation)	R. Stark (NWO)
P. Ehrenfreund (LIC)	D. Stinebring (Oberlin College)
M. Jourdain de Muizon	J.A. Stüwe
J.K. Katgert-Merkelijn	

Emeriti

A. Blaauw (also: Groningen)	K.K. Kwee
W.B. Burton	K.H. Libbenga
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

S.J.T. Bottinelli	NWO	P. Marrese	NWO, GAIA
H. Cuppen	NWO, VENI	R.J. Mathar	NWO, VICI
A. Crapsi	EU/NWO, VIDI	R. McDermid	NOVA, Glass
C. DallaVecchia	EU-EXT	B. Merin Martin	Spanje/Spinoza
J. Falćon Barroso	EU	C.J. Ödman	KNAW
G. Fuchs	NOVA, Sackler	A. Omar	NWO
B. Groves	UL	N.M. Ramanujam	NOVA, LOFAR
P. Hallibert	NOVA Muse	J.P. Reunanen	NOVA Sinfoni
N. Hatch	UL, KNAW	O. Usov	UL, SNN LOFAR
C. Hopman	NWO, VENI	I. van Bemmel	UL, EU SKADS
V. Joergens	EU Marie Curie	R. Williams	NWO
R. Köhler	NWO, VICI		

Ph.D. Students

S. Albrecht	1,9,10	A.H. Pawlik	5
P. Beirao	1	F. Petrignani	7
S. Bisschop	1,2	D. Raban	3
R. van den Bosch	3	J. Ritzerveld	3
J. Bouwman *	8	D. Salter *	1
C. Brinch	5	D.H.F.M. Schnitzeler	3
M. Damen	1,2	D.M. Smit	3
V. Geers	4	L. Snijders	1
M. Haas *		M.H.Soto Vicencio	1
S. Hekker	1,10	K. Torstensson *	12
H. Intema	2,6	L. van Starkenburg (0.8)	1,2
S. Ioppolo *	2	E.N. Taylor	3
T. van Kempen	3,4	H.E. Verbraak	8
M. Kriek	3	L. Vermaas *	2
F. Lahuis (SRON Groningen)	4,7	R.Visser	4
D.J.P. Lommen	2	N.deVries	1
F. Maschietto *	3	N. Wehres *	12
E. Micelotta	5	A. Weijmans	3
K.I. Öberg	5	R. Wiersma	11
J.-P. Paardekoper *	2	S.E.R. Wuyts	3
O. Panić	3,12		

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 from EU EARA MC network; 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.

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

Senior Students (MSc doctoraal curriculum)

N.J.C.P.Baars
M. van den Berg
R. Berkhout
C.C. Bonnett
A. Bos
M.P. den Brok
S.Y. Brown
E.E. Caris alias Reynders
B. Clauvvens
B. van Dam
A. Farzinnia
N. ter Haar
M. Hamelink
G. van Hal
P. Herfst
B. Holl
M.van Hoven
S. de Kievit
T.D.J. Kindt
A.C. Kockx
A.L Kroonenberg
E.J.W. de Mooij
S.V. Nefs
J.B.R. Oonk
S. Ophof
M. Peters
M. van Riet
FJ. Roduner
E.T. van Scherpenzeel
H. Schouten
W.R Spaan
R. Tan
S. Toonen
E. van Uitert
F. van de Voort
R. van Weeren
S.H. Welles
A.N.M. Westmaas
M. Zwetsloot

Msc Students (new curriculum)

T.L. Astraatmadja
A. Jeeson Daniel
A.-M. Madigan
J.M. Martinez Galarza
I. Oliveira (Martins e)
O. Rakic
S. Rusli
L. Stirbat
H. Zeballos Pinto

Bsc Students

T. Boekholt
S. van den Broek
R. van der Burg
M. de Hoon (Delft)
D. Geerts
W. de Pons
I.R. Rosenbrand
J. van de Sande
W.C. Schrier
J.A.P. Severijnen
D. Szomoru
C.H.M. de Valk
A.W. de Vries
F. Vuijsje

Note:
BSc students listed are only those doing a research project.

Staff changes in 2006

Name (funded by)	start	end
O.I.L. Asvany (NWO)		01-07-2006
I. van Bemmel (UL, EU SKADS)	01-10-2006	
R. Blandford (UL, J.H. Oort Fonds)	10-04-2006	13-04-2006
S.J.T. Bottinelli (NWO)	01-10-2006	
J. Bouwman (FOM)	01-02-2006	
M. Cappellari (NWO, VENI)		31-08-2006
H. Cuppen (NWO, VENI)	01-10-2006	
D. van Delft (UL, 0.2)		31-08-2006
B. Groves (UL)	01-11-2006	
C.C. Gündisch (UL)	01-06-2006	
M. Haas (UL)	06-06-2006	
N. Hatch (UL, KNAW)	01-10-2006	
C. Hopman (NWO, VENI)	01-08-2006	
H. Intema (UL, KNAW)		30-06-2006
H. Intema (UL, NOVA)	01-07-2006	
S. Ioppolo (UL, NOVA)	01-09-2006	
B. Jonkheid		30-06-2006
V. Joergens (EU, Marie Curie)		01-04-2006
I.L. ten Kate (NWO, Vernieuwingsimpuls)		26-01-2006 (LIC)
J. Katgert-Merkelijn (UL)		31-12-2006
R. Köhler (NWO, VICI)		30-10-2006
F. Maschietto (NWO)	01-04-2006	
R. Mathar (NWO, VICI)		30-05-2006
R. Mathar (UL, NOVA)	01-06-2006	31-08-2006
R. Mathar (NWO, VICI)	01-09-2006	
R. Meijerink (UL)		09-11-2006
B Merin Martin (Spanje / Spinoza)	01-10-2006	
A. Omar (NWO)	01-10-2006	
R. Overzier		31-07-2006
J.-P. Paardekoper (UL, NOVA)	01-09-2006	
S.-J. Paardekoper (UL)		01-09-2006
O. Panic (NWO VIDI)		14-08-2006
O. Panic (EU Molecular Universe)	15-08-2006	
H.A. Quirrenbach (UL, NOVA)		01-04-2006
S. Reffert-Frink (NWO VICI)		31-03-2006
D. Salter (UL)	15-08-2006	

Staff changes in 2006 (continued)

A. van der Tang (UL)	01-01-2007	
K.J.E. Torstensson (EU, JIVE)	01-09-2006	
K.H. Tran (UL, NOVA)		30-11-2006
O. Usov (UL, SNN LOFAR)	19-10-2006	
L. Vermaas (UL, NOVA)	01-02-2006	
R. Vink (UL, NOVA)		31-08-2006
T.M.A. Webb (NWO, VENI)		15-01-2006
N. Wehres (EU Molec. Universe, Groningen)	01-03-2006	
R. Williams (NWO)	01-09-2006	
P. Woitke (UL)		30-10-2006

Appendix

II

Committee membership

Sterrewacht Leiden

Committee membership

Appendix II

II.1. Observatory Committees

(As on december 31, 2006)

Directorate
(Directie onderzoekinstituut)
P.T. de Zeeuw (director of research)
J. Lub (institute manager)
F.P. Israel (director of education)

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

Oversight council
H. van der Laan (chair)
B. Baud
J.A.M. Bleeker
C.J. Oort
W. van Saarloos

Research committee
(Onderzoek-commissie OZ)
K.H. Kuijken (chair)
A.G.A. Brown
W. Jaffe
P. Katgert
P.P. van der Werf

Research institute scientific council
(Wetenschappelijke raad onderzoekinstituut)

B. Brandl
A.G.A. Brown
P.T. de Zeeuw
E.R. Deul
M. Franx
M. Hogerheijde
V. Icke
F.P. Israel
W.J. Jaffe
P. Katgert
K.H. Kuijken
R.S. Le Poole
Y. Levin
H.V.J. Linnartz
J. Lub
G.K. Miley
H.J.A. Röttgering
J. Schaye
I. Snellen
R. Stuik
P.P. van der Werf
E.F. van Dishoeck

Institute council
(Instituutsraad)

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

Astronomy education committee
(Opleidingscommissie OC)

P.P. van der Werf (chair)
M.C. Damen
J.C. Drost (minutes)
M. Franx
A.J.C.P. Hagenaars
V. Icke
H.T. Intema
R. Leijssen
J.B.R. Oonk
H. Röttgering
J. Schaye
S. Toonen
S. van den Broek

Oort scholarship committee

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

Mayo Greenberg prize committee

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

MSc admission advisory committee

M. Franx (chair)
F.P. Israel
R.S. Le Poole (until October 1)
H.J. Röttgering (after October 1)

Astronomy board of examiners
(Examencommissie)
F.P. Israel (chair until September 1)
J. Lub (chair after September 1)
E. Groenen (Physics)
K.H. Kuijken
P.P. van der Werf

Graduate student review committee
(Commissie studievoortgang promovendi)
W. Boland
B. Brandl
K.H. Kuijken
J. Schaye

Computer committee
S. Bisschop
B. Brandl
A.G.A. Brown
M. Cappellari
K. Groen
S.-J. Paardekooper
P. v.d. Werf

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
T.A. van Kempen (chair)
A.G.A. Brown
E. Caris alias Reynders
K. Groen
I.A.G. Snellen

II.2. Membership of University Committees

(As on december 31, 2006)

Brandl
Member, Research institute scientific council
Member, Graduate student review committee
Member, Computer committee

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

Franx
Member, Astronomy Education Committee
Member, Msc admission committee
Chair, Oort Scholarship committee
Director, Leids Kerkhoven--Bosscha Foundation
Director, Leids Sterrewacht Foundation
Director, Jan Hendrik Oort Foundation

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

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)

Kriek
Member, committee for public outreach

Kuijken
Member, Faculty Research Committee (WECO)
Chair, Observatory Research Committee
Chair, PhD review Committee
Member, Observatory Management Team
Study Advisor, Astronomy BSc students
Member, Astronomy Education Committee
Member, Astronomy MSc Admissions Committee
Member, Lorentz Center Astronomy Programme Board
Member, International Center Board

Linnartz
Observatory representative national science day
Observatory representative press releases
Member, Mayo Greenberg fellowship selection committee
Member, FMD/ELD user committee

Ollongren
Member, Leiden University Committee 'Hoger Onderwijs voor Ouderen' (HOVO, Courses at university level for Seniors)

Röttgering
Member, Education committee

Schaye
Co-chair, Colloquia committee (with Yuri Levin)
Chair, Website committee
Member, Graduate student review committee
Member, Astronomy education committee
Member, Oort scholarship committee
Member, Faculty research committee

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

de Zeeuw
Member, Advisory Committee Lorentz Professor
Member, Advisory Committee Kloosterman Professor
Member, Board of Directors, Leids Kerkhoven Bosscha Fonds
Member, Board of Directors, Leids Sterrewacht Fonds
Member, Board of Directors, Oort Foundation

Appendix

III

Science policy functions

Science policy functions

Appendix III

Brandl
PI, concept study of MIDIR (ELT mid-IR instrument)
Deputy Co-PI, European JWST-MIRI consortium
Instrument Scientist, MIRI
Chair, MIRI SMO subsystem CDR
Member, MIRI DGA subsystem CDR
Member, Spitzer Time Allocation Committee
Member, NL-PC (Dutch observing program committee)
Deputy workpackage manager, ELT Design Study WP11000 (Instrumentation)
Member, ESO ELT Instrument Working Group
Co-Investigator, Spitzer-IRS
Co-Investigator, PHARO camera (Palomar 200")
Co-Investigator, WIRC camera (Palomar 200")
Member, OPTICON Key technologies working group

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

van Delft
Member, jury Eurekaprijs 2006
Member, jury Prijs van Wetenschap en Maatschappij
Member, Commissie Wetenschapsgeschiedenis KNAW
Member, Commissie 'Duizend Meesterwerken'

Member, board Gewina, Nederlands Genootschap voor de Geschiedenis van de Geneeskunde, Wiskunde, Natuurwetenschappen en Techniek.

van Dishoeck
Associate Editor, Annual Reviews of Astronomy & Astrophysics
Member, ALMA Board
Member, SRON Board
Co-PI, European JWST-MIRI consortium
Member, MPIA-Heidelberg Fachbeirat
Member, Visiting Committee Astronomy Department of Harvard University
Member, SMA Advisory Committee
Member, ESO-CRIRES Science Team
Member, Herschel-HIFI Science team
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
Member, Scientific Organising Committee, Nobel symposium on 'Cosmic Chemistry'
Member, Scientific Organising Committee, ALMA workshop on 'Complex Molecules in Space'
Member, Search committee Wykeham Professor of Physics, Oxford University
Member, PhD committee P. Stäuber, ETH
Member, PhD committee A. Isella, University of Milan
Member, PhD committee S. Bottinelli, University of Grenoble

Franx
Member, Advanced Camera for Surveys Science Team
Member, Nova Board
Member, Sinfoni Science Team
Member, ESO-Omegacam science team
Chair, MUSE science team
Member, JWST-NIRSPEC science team
Member, JWST Science Working Group
Chair, ESO-ELT Science Working Group
Member, ESO-ELT Science and Engineering Core Working Group
Chair, NL-PC Allocation Committee
Organizer, Science Meeting in Lorentz Center

Hogerheijde
Member, ALMA European Science Advisory Committee
Member, ALMA Science Integrated Project Team
Member, Netherlands Program Committee
Member, ALMA Regional Center Coordinating Committee
Project scientist for CHAMP+/Netherlands
Member, ESO OPC, period 78
Member, ESO OPC and chair panel C2, period 79
Member, NWO VENI selection committee

Hopman
Member, LISA Science Requirement Document

Israel
Member, NWO Selection Committee for VIDI Awards
Member, IAU Comissions 28, 40 and 51
Member, Science Team Herschel-HIFI
Member, Science Team JWST-MIRI
Member, Science Team APEX-Champ+
Member, Editorial Board Europhysics News

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
Member, ASTRON Board
Member, NOVA Instrument Steering Committee
Member, ESO KMOS Instrument Science Team
Member, Board Pastoor Schmeits Fund
Member, Board Kapteyn Fund
Member, Board EARA
Member, Search Committee ASTRON General Director
Member, Search Committee astronomy professor Radbout University Nijmegen

Member, NWO Advisory Committee Astronomy
External Member, Faculty of Natural Sciences tenure review commitee, University of Groningen
External member, FWO-Vlaanderen Physics and Astronomy Grants Committee
Principal Investigator, NOVA OmegaCAM instrumentation project
Principal Investigator, ESO KiDS Public Survey
Co-investigator, ESO VIKING Public Survey
Co-investigator, Planetary Nebulae Spectrograph project
Chair, LOC and SOC, Oort workshop
Member, NWO STARE programme jury
Deputy network coordinator, EU 6th Framework Programme Research Training Network 'DUEL'
Local coordinator, EU 6th Framework Programme Research Training Network 'SISCO'
Member, board EU 6th Framework RTD Project Astro-WISE

van Langevelde
Member, ESO STC
Chair, ESO VLTI overview committee
Member, ESO contactcommissie
Member, LOFAR international calibration review committee
Member, LOFAR DCLA review committee
Member, NOVA Instrumentation Steering Committee
Member, NOVA onderwijscommissie
Member, RadioNet Executive Board
Member, ESTRELA board
Member, EXPReS Management Team
PI, ALBUS project
PI, FABRIC project

Linnartz
Workgroup leader FOM group FOM-L-027
Workgroup leader FP6 RTN program 'The Molecular Universe'
Member, FOM-NWO working group 'AMO/COMOP'
Member, CW-NWO working group 'Spectroscopy and Theory'
Member/Chairman, NWO Rubicon grant allocation committee.
Editor, Comments on Atomic, Molecular and Optical Physics (part of Phys. Scripta)

Miley
Vice President, International Astronomical Union
Chair, International Universe Awareness Steering Committee
Chair, LOFAR Research Management Committee
Member, LOFAR Astronomy research Committee
Member, Board of Governors of the LOFAR Foundation
Member, National Radio Astronomy Observatory Visiting Committee
Member, Max Planck Institut fur Radioastronomie Fachbeirat
Member, Hubble Space Telescope Time Allocation Committee
Member, Search Committee for Director of Nuffield Radio Astronomy Laboratories, Jodrell Bank, University of Manchester
Member, Search Committee for Director of the ASTRON Foundation
Member, Board EU SKADS Project

Ollongren
Member Permanent SETI Study Group, International Astronautical Academy (IAA)
Member IAU, Commissions 7, 33 and 51
Founding member European Astronomical Society (EAS)

Röttgering
Member, Dutch Joint Aperture Synthesis Team (DJAST)
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)
Chair, 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, LOFAR Research Management Committee (RMC)
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, Curatorium of the professorship at Leiden University "Experimental Astroparticle physics".

Schaye
Member of the executive committee, Virgo Consortium
Member, LOFAR epoch of reionization science team
Member, MUSE science team
Member, EDGE science team
Member, ISSI team on Non-virialized X-ray components in clusters of galaxies.
Member, National research initiative e-science
Member, SOC IAU Symposium 244: 'Dark Galaxies and Lost Baryons'
PI, Marie Curie Excellence Team
PI, OWLS collaboration
Chair, SOC and LOC of the Lorentz Center workshop 'Computational Cosmology'
NL-representative, Euro-VO Data Center Alliance, Theoretical astrophysics Expert Group

Tran
Member, ESO OPC May 2006

Weijmans
Member, National Education Committee Astronomy (LOCNOC)

van der Werf
Member, JCMT Board
Member, 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, MIDIR Study Team
Member, NWO VIDI grant allocation panel

de Zeeuw
co-chair, SOC of Lorentz Center Workshop on Nuclei of Galaxies
Member, Scientific Advisory Board of New Astronomy
Member, MUSE Executive Board
Member, OPTICON Board
Member, National Committee Astronomy
Member, Steering Committee ELT Design Study
Member, ESO Council

Member, KNAW
Chair, ESO Scientific Strategy Working Group
Chair, ESO Contact Committee
Chair, Space Telescope Institute Council
Leiden University Member Representative to AURA
Member, AURA Board of Directors
Member, ESA Space Science Advisory Committee
Chair, Science Vision Working Group, EU--ASTRONET
Director, Netherlands Research School for Astronomy, NOVA

Appendix

IV

Visiting scientists

Sterrewacht Leiden

Visiting scientists

Appendix IV

Name	Dates	Institute
J.A. Peacock	Jan 20	Edinburgh, UK
Y. Mellier	Jan 20	IAP, Paris, France
P. Schneider	Jan 20	Argelander-Institut, Bonn, Germany
M. Radovich	Jan 20	Naples, Italy
R. Silvotti	Jan 20	Naples, Italy
R. Saglia	Jan 20	MPE, Garching, Germany
E. Valentijn	Jan 20	Kapteyn Institute, Groningen, Netherlands
A. van der Wel	Jan 30 - Feb 1	Johns Hopkins University, USA
K. Gebhardt	Feb 2-3	University of Texas, USA
S. Doty	Feb 7 - Apr 30	Denison University, USA
R. Morganti	Feb 14	ASTRON, Dwingeloo, Netherlands
A. Monachesi	Feb 21-22	La Plata Observatory, Argentina
I. Kamp	Mar 6-12	Space Telescope Science Institute, USA
P. Dayal	Mar 9-11	Sussex University, UK
M. Hoeft	Mar 14-17	University of Bremen, Germany
R.J. Wilman	Mar 20-22	Durham University, UK
J.L. Cervantes	Mar - May	IAC Tenerife, Spain
R. Morganti	Apr 3	ASTRON, Dwingeloo, Netherlands
R.D. Blandford	Apr 10-13	Stanford, USA
M. Elitzur	Apr 24-28	University of Kentucky, USA
M. Mac Low	May 4	American Museum of Natural History, USA
B. Matthews	May 12-15	Herzberg Inst. for Astrophysics, Canada
P. van Dokkum	May 29-31	Yale University, USA

G.A. Blake	Jun 8-10 & 16-17	Caltech, USA
N. Förster-Schreiber	Jun 12-14	MPE, Garching, Germany
S. Bertone	Jun 19-26	Sussex University, UK
A. Biviano	Jul 15-22	Osservatorio Astronomico, Trieste, Italy
K. Shapiro	Jul 17 - Aug 7	Berkeley, USA
M. Maier	Jul 18-31	University of Oxford, UK
D. Richstone	Jul 20-22	University of Michigan, USA
K. Gebhardt	Jul 20 - Aug 11	University of Texas, USA
R.D. Blandford	Jul 24 - Aug 5	Stanford, USA
A.K.Y. Ngai	Jul 26 - Sep 15	Radboud University Nijmegen, Netherlands
B. Miller	Aug 1-5	Gemini Observatory, Hawaii USA
A. van der Wel	Aug 1-11	Johns Hopkins University, USA
M. Bremer	Aug 7-11	University of Bristol, UK
R. Jacques	Aug 8-18	Institut d'astrophysique de Paris, France
H.J. Fraser	Aug 14-19	Strathclyde University, UK
J.A. Noble	Aug 14-19	Strathclyde University, UK
S. Baillie	Aug 14-19	Strathclyde University, UK
G. van der Wolk	Aug 21-22	University of Groningen, Netherlands
D. Heisselmann	Aug 28-29	TU Braunschweig, Germany
M. Kraus	Aug 28-29	TU Braunschweig, Germany
D. Hemberger	Sep 4 - Nov 11	Oberlin College, USA
S. Bertone	Sep 18-22	Sussex University, UK
M Kirsanova	Sep 20 - Dec 20	INASAN, Moskau, Moscow, Russia
S. Longmore	Oct 9-12	ATNF Sydney, Australia
I. Ch. Chenakkod	Oct 16-20	National Center for Radio Astrophysics, India
W. Thi	Oct 16-27	Royal Observatory, Edinburgh, UK
G. Illingworth	Oct 30 - Nov 1	Lick Observatory, USA
R.M. Rich	Nov 4-7	UCLA, USA
S. Weinmann	Nov 14-16	University of Zurich, Switzerland
E. Emsellem	Nov 23-24	Observatoire de Lyon, France
D. Krajnovic	Nov 23-24	University of Oxford, UK
M. Cappellari	Nov 23-24	University of Oxford, UK
D. Smith	Nov 28-29	Oxford, UK
M. Freitag	Dec 5	Cambridge, UK
A. Blaauw	Dec 19	University of Groningen, Netherlands

Appendix V

Workshops, lectures, and colloquia in Leiden

Workshops, lectures and colloquia in Leiden

Appendix V

V.1. Workshops

The workshops were held in the Lorentz Center, an international center which coordinates and hosts workshops in the sciences. In 2006 the Leiden astronomers contributed to the following workshops there:

February 20 - 23
Herschel Key Program
T. de Graauw, M. Griffin, P. Harvey, F.P. Helmich, G. Pilbratt, A. Poglitsch, X. Tielens

February 28 - March 1
NIRspec Science meeting
M. Franx

March 6 - 10
The World a Jigsaw:
Tessellations in the Sciences
R. van de Weygaert, V. Icke, G. Vegter, J. Ritzerveld

April 3 - 7
Key Programs of the HIFI Consortium
X. Tielens, T. de Graauw, F.P. Helmich

April 7
Leidse Natuurkunde Middag
H. Buisman, M. Franx, E. Groenen, F. Israel

July 24 - 28
Galactic Nuclei
K. Gebhardt, D.O. Richstone, R.M. McDermid, P.T. de Zeeuw

July 31 - August 4
Gravitational Lensing (Oort workshop)
R. Blandford, K.H. Kuijken, L.V.E. Koopmans, Y. Mellier, P. Schneider

September 4 - 9
Laboratory Cosmology
A. Achúcarro, A.C. Davis, G. Pickett, G. Volovik

October 9 - 13
Universe Awareness
C. Madsen, G.K. Miley, C. Odman, C. Scorza de Appl

October 24 - 27
From Brown Dwarfs to Planets: Chemistry and Cloud Formation
M. Fridlund, Ch. Helling, T. Guillot, P. Hauschildt, M.S. Marley, D. Stam, H. Rauer

November 6 - 10
Dissecting the Milky Way
A. Helmi, H.W. Rix

November 13 - 17
Studies of Infrared Selected Galaxies
M. Franx

November 20 - 24
Astrowise
E. Valentijn, E. Deul

November 27 - December 1
Perspectives on Scientific Practice from Science and the Science Studies
D. van Delft, J.W. McAllister, R.P.W. Visser

December 6 - 8
Molecular databases for Herschel, ALMA and SOFIA
J.C. Cernicharo, E. Caux, Th. de Graauw, X. Tielens

Galactic Nuclei
http://www.lorentzcenter.nl/lc/web/2006/207/info.php3?wsid=207

During July 24-28th, McDermid and de Zeeuw, together with Richstone (Michigan) and Gebhardt (Austin), co-organized a workshop on the nuclei of 'normal' early-type galaxies. This workshop brought together key members of two international research teams: the European "SAURON" team, and the American "NUKER" team; to discuss the latest developments in the field of galaxy nuclei, dynamical modeling of galaxies, and galaxy structure and evolution. In addition, key collaborators of these teams were also invited to broaden the discussion topics, which ranged from black-hole mass scaling relations, to massive galaxy formation in clusters. Several collaborative projects were started between the teams, including a joint program using the Gemini telescope to study massive black holes in galaxy centers. Sharing of data and cross-checking of results and methods were initiated, and a number of manuscripts in preparation were shared between the groups, triggering feedback and discussion. These interactions have lead to several joint observing proposals, and collaboration on papers now in progress.

V.2. Endowed Lectures

Date	Speaker (affiliation)	Title
Apr 12	Roger Blandford (KIPAC)	*Exploring the Distant Universe with Gravitational Telescopes* (Oort lecture)
Dec 6	Charles Steidel (Caltech)	*Galaxy Formation: What are we missing?* (Sackler Lecture)

V.3. Scientific Colloquia

Date	Speaker (affiliation)	Title
Jan 12	Inge Loes ten Kate (Leiden University)	*Laboratory studies of organic material under simulated martian conditions*
Jan 19	Conny Aerts (Katholieke Universiteit Leuven)	*Asteroseismology: from the Sun to Stars*

Jan 26	Andrea Ferrara (SISSA)	*First Stars and the Cosmic Dawn*
Feb 2	Karl Gebhardt (University of Texas)	*Black Holes of All Masses: Understanding the Fundamental Correlations*
Feb 9	Wim Hermsen (SRON)	*Science High Lights from INTEGRAL*
Feb 16	Eline Tolstoy (Rijksuniversiteit Groningen)	*Chemo-dynamics of dwarf spheroidal galaxies*
Feb 22	Juergen Blum (Technische Universität zu Braunschweig)	*Planet Formation in the Laboratory*
Mar 2	John Faulkner (UC Santa Cruz and Sternwarte München)	*Standing on the shoulders of dwarfs: How and why stars become red giants*
Mar 9	Andreas Quirrenbach (Sterrewacht Leiden)	*Direct and Indirect Detection of Extrasolar Planets*
Mar 16	Matthias Hoeft (International University Bremen)	*The radio signature of structure formation shock*
Mar 23	Hans van der Marel (TU Delft)	*Galileo*
Mar 30	Kim-Vy Tran (Sterrewacht Leiden & Center for Astrophysics)	*The Origin of Early-Type Galaxies in Rich Clusters*
Apr 6	Stephen Shectman (Carnegie)	*The Giant Magellan Telescope*
Apr 20	Simon Jeffery (Armagh Observatory)	*Evolution and Pulsations of Extreme Helium Stars*
Apr 27	Moshe Elitzur (University of Kentucky & LAOG, Grenoble)	*The AGN obscuring torus - end of the "bagel" paradigm?*
May 4	Mordecai-Mark Mac Low (American Museum of Natural History)	*Control of Star Formation in Galaxies by Gravitational Instability and Supersonic Turbulence*
May 18	Roderik Overzier (Sterrewacht Leiden)	*Protoclusters*
Jun 1	Daniel Schaerer (Observatoire de Geneve)	*High redshift lensed galaxies observed with the VLT, HST and Spitzer*
Jun 8	Sijme-Jan Paardekooper (Sterrewacht Leiden)	*Growing and Moving Planets in Disks*
Jun 15	Bastiaan Jonkheid (Sterrewacht Leiden)	*Chemistry in Evolving Protoplanetary Disks*
Jun 22	Nicholas Walton (Institute of Astronomy, Cambridge)	*Virtual Observatory (TBD)*
Jun 29	Gustavo Bruzual (CIDA, Venezuela)	*Stellar Population Models at High Spectral Resolution*

Jul 25	Roger Blandford (Kavli Institute)	*B1608+656: a case study in gravitational lensing*
Jul 28	Roger Blandford (Kavli Institute)	*The future of strong lensing*
Sep 7	Richard Manchester (ATNF)	*Pulsars and Gravity*
Sep 14	Søren Larsen (Universiteit van Utrecht)	*Star Clusters as Building Blocks of Galaxies*
Sep 21	Shri Kulkarni (Caltech)	*An Explosion of Cosmic Explosions*
Sep 29	Willy Kley (Tübingen)	*Evolution of Extrasolar Planetary Systems*
Oct 5	Robert Kennicutt (Cambridge)	*Nearby Galaxies as Revealed by the Spitzer Space Telescope*
Oct 12	Wim Ubachs (Vrije Universiteit Amsterdam)	*Precision Spectroscopy of H_2 and a Possible Variation of $m_p m_e$ over Cosmological Time*
Oct 19	Rowin Meijerink (Sterrewacht Leiden)	*Models of the Interstellar Medium in Galaxy Center (PhD thesis colloquium)*
Oct 26	Jean-Pierre Lebreton (ESA)	*The Cassini-Huygens Mission around Saturn: Lifting Titan's veil after Huygens landing*
Nov 2	Rob Ivison (Edinburgh/Hertfordshire)	*Submm Cosmology: Witnessing the Formation of Elliptical Galaxies*
Nov 9	Ken Freeman (ANU)	*The Dynamical History of the Galaxy*
Nov 16	Ian Bonell (St. Andrews)	*Star Formation: From Molecular Clouds To Stellar Masses (NOVA colloquium)*
Nov 23	Ravi Sheth (Upenn)	*The Halo Model of Large Scale Structure (NOVA colloquium)*
Nov 30	Rachel Somerville (MPIA)	*Mass Assembly and Downsizing: Hierarchical Models Confront Observations (NOVA colloquium)*
Dec 14	Stephane Udry (Geneva)	*Radial-Velocity Planet Search: Fruitful Past and Bright Future*

V.4. Student Colloquia

Date	Speaker (affiliation)	Title
Jan 23	Marieke van Duin	*Massive star formation in W49A N Confirmed HL 427*
Feb 21	Rogier Ensing	*Over de Verhandelingen van het Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia, 1911-1949*
Mar 22	Franco Maschietto	*Sampling the world with point processes*
Apr 4	Dave van Eijck	*Concept study for ARTEMIS. A Revolutionary TEchnique for Mid-Infrared Surveys*
May 15	Guido Kosters	*H2 emission from the central region of the merger galaxy NGC 6240*
Jun 26	Demerese Salter	*The Evolutions State of Embedded Lada Class I Young Stellar Objects in the rho Ophiuchus Dark Cloud*
Aug 15	Paul Verburg	*Radiating Planetary Nebulae*
Aug 15	Eveline Helder	*Gas orbits in a barred galaxy*
Aug 16	Sebastiaan Veijgen	*Wolf-Rayet stars: The variability of WR 103*
Aug 16	Jan-Pieter Paardekooper	*Leiden Hydrodynamics with SimpleX Radiative Transfer*
Aug 18	German Chaparro	*Capture of young fly-by stars by a cluster of stellar-mass black holes around the supermassive black hole at SgrA**
Aug 18	Stefan van Dongen	*Stacking analysis of* $2 < z < 3.5$ *galaxies*
Oct 20	Evelyn de Wachter	*Silicon Solar Cells*
Oct 31	Arno Kockx	*Gravitational Lensing And The Mass Distribution In Abell 1689*
Nov 13	Raymond Oonk	*Compact Galaxies in the Submm*

Appendix

VI

Participation in scientific meetings

Participation in scientific meetings

Appendix VI

Albrecht
SPIE Astronomical Telescopes and Instrumentation, Orlando, Florida , USA; May 24 - 31
'10-micron interferometry of the disk and wind of the massive young star MWC349A'
Observation and Data Reduction with the Very Large Telescope Interferometer, Goutelas, France; June 5 - 16

Beirao
Studying Galaxy Evolution with Spitzer and Herschel (Agios Nicolaos, Greece; May 28-June 2)
'Spitzer-IRS Spectroscopy of the Central Region of M82'
IPAC Symposium (Pasadena, USA; Oct 3-5)
'Spitzer-IRS Spectroscopy of the Central Region of M82'

Bisschop
Complex Molecules in space present status with ALMA (Mols, Denmark; May 8-11)
'Testing grain-surface chemistry through observations'

Brandl
SPIE Conference on Telescopes and Instrumentation (Orlando, Florida; May 23-31)
'MIDIR/T-OWL, the thermal/mid-IR Instrument for the E-ELT'
ULIRG Workshop (Cornell/Ithaca, USA; Jun 17-22)
'Spitzer-IRS Spectroscopy of Starburst Galaxies'
IAU General Assembly (Prague, Czechia; Aug 13-19)

Toward the E-ELT (Marseille, France; Nov 26-Dec 1)

Brinch
Disks2006 (Vidago, Portugal; Sep 18-23)
'High Resolution Imaging of L1489 IRS. A Protoplanetary Disk in Formation?'
PLANETS meeting (Heidelberg, Germany; 25-28)
'Probing Disk Formation with Molecular Lines'
ALMA2006 (Madrid, Spain; Nov 13-17)
'High Resolution Imaging of L1489 IRS. A Protoplanetary Disk in Formation?'

Brown
Gaia Coordination Unit 3 'Core Processing' meeting (Heidelberg, Germany, Feb 23-24)
Gaia Coordination Unit 8 'Astrophysical Parameters' meeting (Nice, France, Mar 16-17)
'Details of the new photometric instrument'
Gaia Coordination Unit 4 'Object Processing' meeting (Brussels, Belgium, Apr 3-5)
'Details of the new photometric instrument'
Nederlandse Astronomen Conferentie (Ameland, Netherlands, May 10-12)
'Gaia: the new EADS-Astrium design and plans for data processing'
Gaia joint Coordination Unit 2 'Simulations' and CU5 'Photometric Processing' meeting (Barcelona, Spain, June 6-9)
'Multi-colour photometry with dispersed images in the new Gaia design'
XXVIth IAU General Assembly (Prague, Czech Republic, Aug 21-25)
'Gaia - Taking the Galactic Census: Where are we now? (Commission 8)'
'Gaia - Taking the Galactic Census (Gaia fringe meeting)'
Gaia Coordination Unit 5 'Photometric Processing' meeting (Cambridge, United Kingdom, Sep 25-26)
Gaia Initial Data Treatment meeting (Barcelona, Spain, Oct 16-17)
'Initial data treatment and CU5'
Lorentz Center workshop: Dissecting the Milky Way (Leiden, Netherlands, Nov 6-10)
'Gaia - Taking the Galactic Census'
Gaia Coordination Unit 5 'Photometric Processing' calibration meeting (Barcelona, Spain, Dec 13-14)
'CU5 and Initial Data Treatment/ Intermediate Data Update'
'BP/RP wavelength calibration'

Cuppen
Molecular databases for Herschel, ALMA and SOFIA (Leiden, Dec 6-8)
'Monte Carlo Studies of Surface Chemistry'

Dalla Vecchia
Virgo Meeting (Nottingham, United Kingdom; Jun 07-09)
'OWLS project: star formation history'
Heating vs. Cooling in Galaxies and Clusters of Galaxies (Garching, Germany; Aug 06-11)

Damen
Cosmic Frontiers (Durham, UK, Jul 31 - Aug 4)
IAU General Assembly (Prague, Czech Republic, Aug 14-24)
Studies of Infrared Selected Galaxies (Leiden, Nov 13-17)

van Dishoeck
Astrobiology Science Conference (Washington, USA; Mar 26-28)
'Chemistry in star- and planet-forming regions: ice cold and steaming hot' (invited talk)
Molecules in Space, American Chemical Society (Atlanta, USA; Mar 28-31)
'The physical and chemical structure of protostellar envelopes: ice cold and steaming hot' (invited talk)
Spitzer 'Cores to Disks' IRS Legacy Team Meeting (Austin, USA; Apr 2-4)
'Overview of Spitzer c2d IRS results'
Herschel-HIFI Water in Star-Forming Regions KP Meeting (Leiden, Netherlands; Apr 6-7)
'Water observations of low-mass protostars; meeting summary'
Chemical Evolution of the Universe (St. Jacut, France; Apr 24-26)
'Photoprocesses in protoplanetary disks' (invited paper)
Complex Molecules in Space (Fuglsoe, Denmark; May 8-11)
'ALMA and chemistry surveys' (invited review)
Spitzer 'Cores to Disks' Legacy Team Meeting (Flagstaff, USA; May 14-21)
'Overview of Spitzer c2d IRS results'
Highlights in Astrochemistry and Astrobiology (Heidelberg, Germany; May 29)
'Astrochemical evolution from low-mass YSOs to protoplanetary disks'

The Planet-Disc Connection (Cambridge, UK; Jul 19-21)
'*Spitzer spectroscopy of transitional disks in the c2d legacy survey*'
(invited talk)
IAU XXVI General Assembly (Prague, Czech Republic; Aug 15-22)
'*Solid-state data needs for infrared astronomy*'
From Dust to Planetesimals (Ringberg, Germany; Sep 11-12)
'*Spitzer spectroscopy of dust in disks*' (invited review)
Massive star formation: a meeting honoring Malcolm Walmsley
(Bonn, Germany; Oct 23)
EU-PLANET Network Meeting
(Heidelberg, Germany; Oct 25-28)
'*Overview of Spitzer-IRS results from the c2d legacy program*'
Science with ALMA: a New Era for Astrophysics
(Madrid, Spain; Nov 8-11)
'*Star formation with ALMA*' (invited review)
Molecular Databases for Herschel, ALMA and SOFIA
(Leiden, Netherlands; Dec 6-8)

van Delft
Museum Boerhaave en (modern) verzamelen (Bergen aan Zee, Netherlands; May 16-17)
Perspectives on Scientific Practice from Science and the Science Studies
(Lorentz Center Leiden, Netherlands; Nov 27-Dec 1)

Franx
ESO ELT-Science Working Group (Garching, Germany; Jan 16-17)
ESO ELT-Science Working Group (Garching, Germany; Feb 17)
ESO ELT-SWG and ELT-ESE (Garching, Germany; Mar 21-23)
Muse science team (Lyon, France; Mar 6-7)
Galaxies and Structures through Cosmic Times (Venice, Italy; Mar 27-29)
ELT-ESE (Garching, Germany; Apr 21)
ESO ELT-SWG and ELT-ESE (Garching, Germany; Apr 27-28)
UDS team meeting (Nottingham, UK; Jun 15-16)
Harvard-Smithsonian Center for Astrophysics (Cambridge, USA; Jul 28 - August 19)
VISTA survey meeting (Edinburgh, UK; Jun 20-21)
JWST Science Working Group (Montreal, Canada; Jun 27-29)
New Cosmology Results from the Spitzer Space Telescope, IAU-JD15
(Prague, Czech Republic; Aug 21-23)

Galaxy Evolution across the Hubble Time IAU 235 (Prague, Czech Republic;
Aug 16-18)
ESO ELT-ESE meeting (Garching, Germany; Sep 13-15)
ESO ELT-SWG meeting (Garching, Germany; Sep 20-21)
ACS Science Team meeting (Jackson Hole, USA; Sep 24-30)
ESO ELT-SWG and Instrument working group meeting (Garching, Germany; Oct 4-5)
JWST Science Working Group (Goddard, USA; Oct 23-24)
Yale University (New Haven, USA; Oct 25-26)
Nirspec Science Team (Paris, France; Nov 2-3)
Towards the European ELT (Marseille, France; Nov 28-December 1)

Fuchs
NASA Astrophysics workshop (Las Vegas, NV, USA; Feb 14-16)
Faraday Discussion 133 (St.Jacut de la Mer, France; Apr 24-26)
Molecular Database for Herschel, AlMA and Sofia (Lorentz Center, Leiden, The Netherlands, Dec 6-8)

Geers
ISM-CSM meeting (Amsterdam, Netherlands; Mar 15)
c2d IRS team meeting (Austin, USA; Apr 2-7)
IoA Conference: Planet-Disc connection (Cambridge, UK; Jul 17-21)
'PAHs in circumstellar disks around T Tauri stars'
Ringberg Workshop: From Dust to Planetesimals (Ringberg, Germany; Sep 11-15)
'PAHs in T Tauri Disks'
Workshop: Physical processes in circumstellar disks around young stars (Vidago, Portugal; Sep 18-22)
'PAHs in circumstellar disks around T Tauri stars'
ISM-CSM meeting (Leiden, Netherlands; Oct 10)
'PAHs in T Tauri Disks'

Haas
Nederlandse Astronomen Conferentie (Ameland, The Netherlands; May 10-12)
'A maximum star cluster mass in the disk of M51'

Mass loss from stars and the evolution of stellar clusters (Lunteren, Netherlands; May 29 - Jun 1)
'Variation of the cluster luminosity function across the disk of M51'
NOVA Fall School (Dwingeloo, Netherlands, Oct 9-13)

Hekker
Nederlandse Astronomen Conferentie (Ameland, Netherlands; May 10-12)
'Analysis of line profile variations of pulsating red giants'
Exo-planets (Geneva, Swiss; Jun 28-30)
SOHO 18/ GONG 2006/ HelAs 1 Beyond the spherical sun (Sheffield, Great Britain; Aug 7-11)
'A line profile analysis of the pulsating red giant star Epsilon Ophiuchi (G9.5III)'
Cool stars conference (Pasadena, United States; Nov 6-10
'Can star spots mimic the long term sinusoidal radial velocity variations in observed red giants?'
'A line profile analysis of the pulsating red giant star Epsilon Ophiuchi (G9.5III)'

Hill
Fifth IRAM Millimeter Interferometry School (Grenoble, France; Oct 2-6)
Workshop on Measurement of Atmospheric Water Vapour: Theory, Techniques, Astronomical and Geodetic Applications (Wettzell / Hoellenstein, Germany; Oct 9-11)
Science with ALMA: a new era for astrophysics (Madrid, Spain; Nov 13-17)
'Profiling young massive stars'

Hogerheijde
Spitzer Legacy team "Cores to Disks" IRS team meeting (Austin TX, USA; Apr 1-5)
Herschel/HIFI Key program meeting (Leiden, Netherlands; Apr 6-7)
Nederlandse Astronomen Conferentie (Ameland, Netherlands; May 10-12)
Disks 2006 (Vidago, Portugal; Sep 17-23)

Hopman
Galactic Center Workshop 2006 (Bad-Honnef, Germany; Apr 18-22)
'Resonant Relaxation near the Massive Black Hole in the Galactic Center'

6th International LISA Symposium (Goddard Space Flight Center Greenbelt, Maryland, USA, Jun 19-23)
'Astrophysics of extreme mass ratio inspiral sources'
LISA Astro-GR@AEI (Golm, Germany, Sep 18-22)
'The astrophysics of EMRIs'

Icke
Workshop Tessellations (Lorentz Centre, Leiden, Netherlands; Mrt 6-9)
Nederlandse Astronomen Conferentie (Ameland, The Netherlands; May 10-12)
'The sound of a tessellated star'
Red Rectangle Conference (Charlottesville, USA; May 22-25)
'Shock Shapes and Toroidal Obstructions'
VU Conferentie 'Fast & Slow' (Nov 23)
'Hoe lang duurt een ontdekking?'
Science and greasepaint (Lorentz Centre, Leiden, Netherlands; Nov 30)

Israel
Workshop on Dwarf Galaxies as Astrophysical and Cosmological Probes (Schloss Ringberg, Tegernsee, Germany; Mar 12-17)
Invited Review: *'Cold Dust in Dwarf Galaxies'*
Nederlandse Astronomen Conferentie (Ameland, Netherlands; May 10-12)
Large Astronomical Infrastructures at CONCORDIA, prospects and constraints for Antarctic optical/IR Astronomy (Roscoff, France; Oct 16-19)
Invited Review: *'Modern Views of the Magellanic Clouds'*

Jaffe
Director, NEVEC
Member, IAU Commission 40, 28
Chairman, ESO User's Committee
Member ESO Contact Committee
Member FITS Working Group

Koehler
IAU Symp. No. 240, 'Binary Stars as Critical Tools and Tests in Contemporary Astrophysics', **IAU General Assembly** (Prague, Czech Republic, Aug 21-26)
Two contributions:
'Binary Stars in the Orion Nebula Cluster'
'The Orbit of T Tauri South'

Kriek
Galaxies and Structures Through Cosmic Times (Venice, Italy; Mar 26-31)
'Spectroscopic Confirmation of Evolved Galaxies at z~2.5'
Cosmic Frontiers (Durham, UK; Jul 31 - Aug 4)
'Suppressed Star Formation in Massive z~2.5 *Galaxies'*
Galaxy Evolution across the Hubble Time (IAU S235) (Prague, Czech Rep., Aug 14-17)
'Spectroscopic Identification of Massive z~2.5 Galaxies with Strongly Suppressed Star Formation'
Massive Galaxies over Cosmic Time 2 (Tucson (AZ), USA; Nov 1-3)
'AGNs and Suppressed Star Formation in Massive z~2.5 Galaxies'

Kuijken
Galaxies and Structures through Cosmic Times - Mapping the Universe (Venice, Italy; Mar 27 - 31)
'KiDS: Mapping the universe with weak lensing'
Cosmology, Galaxy Formation and Astroparticle Physics on the Pathway to the SKA (Oxford, UK;Apr 10-12)
'Weak Lensing on the Pathway to SKA'
Euro Science Open Forum 2006 (Munich, Germany; Jul 18 - 19)
'Studying dark energy with light rays'
IAU General Assembly, Joint Discussion on Virtual Observatory (Prague, Czech Republic, Aug 14-19)
Large Surveys and the VO Gravitational Lensing KITP Study Programme (KITP, Santa Barbara, USA, Oct 2-20)
'KiDS: Studying Dark Matter and Dark Energy with Light Rays'

van Langevelde
RadioNet FP7 brainstorm, (Volterra, Italy; Apr 20)
'Proposals for JRA's on algorithm and software development'

Next Generation Correlator workshop (Groningen, Netherlands; Jun 27-29)
'FABRIC, a pilot study of distributed correlation'
EVN symposium (Torun, Poland; Sep 26-29)
'Data processing software for Radio Astronomy'
ALMA Science symposium (Madrid, Spain; Nov 13-17)

Linnartz
CW meeting 'Spectroscopy and theory' (Lunteren, Netherlands, Jan)
Dutch inter/circumstellar matter meeting (Amsterdam, Netherlands, Mar)
Faraday Discussions 'Chemical evolution of the universe' (St. Jacut, France, Apr)
Carbon in space meeting (Menaggio, Italy, May)
Nobel symposium on cosmic chemistry and molecular astrophysics (Soedertuna, Sweden, Jun)
1st international workshop on infrared plasma spectroscopy (Greifswald, Germany, Jun)
Cavity ring down user meeting (Cork, Ireland, Sep)
Dutch inter/circumstellar matter meeting (Leiden, Netherlands, Oct)
Molecular databases for Herschel, ALMA and SOFIA (Leiden, Netherlands, Dec)

Lommen
IoA Conference 2006: The Planet-Disc Connection (Cambridge, United Kingdom; Jul 17-21)
'Observing grain growth in protoplanetary disks'
Disks2006 (Vidago, Portugal; Sep 18-23)
'SMA observations of Elias 29 and IRS 63: two of Class I, not two of a kind'
Fifth IRAM Interferometry School (Grenoble, France; Oct 2-6)
'SMA observations of Elias 29 and IRS 63: two of Class I, not two of a kind'

McDermid
Fine-Tuning Stellar Population Models (Lorentz Centre, Leiden, Netherlands; Jun 26-30)
'Young Nuclei in Early-Type Galaxies'
Fate of Gas in Galaxies (Dwingeloo, Netherlands; Jul 12-14)
'Connecting stars and ionised gas with integral-field spectroscopy'

IAU General Assembly (Prague, Czech Republic; Aug 21-26
'Stellar Populations of Kinematically Decoupled Cores in E/S0 Galaxies'
Stellar Populations as Building Blocks of Galaxies (La Palma, Spain; Dec 10-16)
'Kinematically and Chemically Decoupled Cores in E/S0 Galaxies with SAURON and OASIS'

Miley
Second Universe Awareness Workshop (Lorentz Center, Leiden; Oct 9-13)
'Universe Awareness, an international inspirational programme for disadvantaged children'
IAU General Assembly (Prague, Czech Republic; Aug 21-26)
'Universe Awareness, an international inspirational programme for disadvantaged children'

Oberg
Faraday Discussions 133: Chemical Evolution of the Universe (Abbaye de St Jacut, France; Apr 24-26)
Young Researchers' meeting on Astrochemistry (London, UK; Sep 21)
'Is interstellar ice dirty - and does it matter?'

Oliveira
EU Planet Network (Heidelberg, Germany; Oct 26-27)

Omar
MeqTree Workshop 2006 (Dwingeloo, Netherlands; Oct 16-27)

Overzier
The fate of gas in galaxies (Dwingeloo, Netherlands; Jul 12-14)
'The formation of brightest cluster galaxies'

Panic
Complex Molecules in Space - Present status and prospects with ALMA, (Aarhus, Denmark; May 8-11)
Summer school on Molecular Astrophysics (Ile de Berder, France; Aug 28-Sep 1)
Disks2006: Workshop on Physical Processes in Circumstellar Disks around Young Stars (Vidago, Portugal; 18-23 Sep)

'The disk around HD169142 resolved in 13CO/C18O J=2-1 lines using the SMA'
Fifth IRAM Millimeter Interferometry School (Grenoble, France; Oct 2-6)
'The disk around HD169142 resolved in 13CO/C18O J=2-1 lines using the SMA'
Science with ALMA: a new era for Astrophysics (Madrid, Spain; 13-17 Nov)
'The disk around HD169142 resolved in 13CO/C18O J=2-1 lines using the SMA'

Pawlik
Nederlandse Astronomen Conferentie (Ameland, Netherlands, May 10-12)
Cosmology and Astroparticle Physics (Trieste, Italy, Jul 10-21)
NOVA Fall School (Dwingeloo, Netherlands, Oct 9-13)

Röttgering
LOFAR workshop (Cambridge, UK; Feb 9)
'Extragalactic surveys with LOFAR'
Darwin science team meeting (Estec, Noordwijk, Netherlands, Apr 3-4)
SKA conference (Oxford, UK Apr 11-12)
'LOFAR - Opening up a new window on the Universe'
TPF science working group meeting (Washington, USA, May 7-9)
TPF science working group meeting (Boulder, USA, Sept 21-22)
LOFAR calibration review (Groningen, Netherlands, Nov 5-7)
Darwin/TPF workshop (Pasadena, USA, Nov 8-12)
'General astrophysics with Darwin/TPF'
Fires workshop (Leiden, Nov 13-17)
Darwin science team meeting (Estec, Noordwijk, Netherlands, Dec 7-8)

Salter
ISM/CSM Meeting (Amsterdam, Netherlands; Mar 15)
Nederlandse Astronomen Conferentie (Ameland, Netherlands; May 10-12)
'The Evolutionary State of Embedded Class I YSOs in rho Ophiuchus' (Poster)
ISM/CSM Meeting (Leiden, Netherlands; Oct 10)
Schaye
MUSE Science team meeting (Lyon, France; Mar 7-8)
'Simulations of Lyman alpha and absorption line systems'
The Scientific Requirements for Estremo/WFXRT (Bologna, Italy; May 4-5)
'What can we learn from the WHIM? (invited)'

Virgo Collaboration Meeting (Nottingham, U.K.; Jun 7-9)
'The OWLS project'
The First Stars and Evolution of the Early Universe (Seattle, USA; Jul 3-7)
Non-virialized X-ray Components in Clusters of Galaxies (Bern, Switzerland; Oct 30 - Nov 3)
'Simulating the WHIM (invited)'
The Kennicutt-Schmidt Law (San Diego, USA; Dec 18-19)

van Scherpenzeel
Nederlandse Astronomen Conferentie (Ameland, Netherlands; May 10-12)

Schnitzeler
IGPS annual meeting (Calgary, Canada; May 28-30)
'The WENSS and Dwingeloo surveys and the Galactic magnetic field' (oral presentation)
Turbulence in the magnetized interstellar medium (Perm, Russia; Sep 6-8)
Idem

Smit
Nederlandse Astronomen Conferentie (Ameland, Netherlands; May 10-12)
'Light Weighed: Weak Lensing with KIDS'
Statistical Challenges in Modern Astronomy IV (State College, USA; Jun 6-15)
Gravitational Lensing (Oort Workshop) (Leiden, Netherlands; Jul 31 - Aug 4)
Astronomical Image Processing Workshop (Dubrovnik, Croatia; Sep 4-8)
AstroWISE Workshop (Leiden, Netherlands; Nov 20-24)

Snijders
IAU General Assembly (Prague, Czech Republic; Aug 14-23)
IAU S237: Triggered Star Formation in a Turbulent ISM (Prague, Czech Republic; Aug 1-18)
IAU JD14: Modeling Dense Stellar Systems (Prague, Czech Republic; Aug 22-23)

Stuik
SPIE conference on Astronomical Telescopes and Instrumentation 2006-Advancements in Adaptive Optics II (Orlando, USA; May 24-31)
'ASSIST: The Adaptive Secondary Setup and Instrument Stimulator'
SPIE conference on Astronomical Telescopes and Instrumentation 2006-Advancements in Adaptive Optics II (Orlando, USA; May 24-31)
'HORATIO: The Leiden High-Order Adaptive Optics Testbed'
Towards the European ELT (Marseille, France; Nov 26 - Dec1)

Taylor
Cosmic Frontiers (Cardiff, England; Jul 31-Aug 4)
'The Emergence of the Red Sequence at z~1.5' (Poster)
IAU General Assembly (Prague, Czech; Aug 14-25)
'On Star Formation and Dark Galaxies'

Torstensson
Tenth Summer Synthesis Imaging Workshop (Albuquerque, NM, USA; Jun 13-20)
8th EVN Symposium 2006 (Torun, Poland; Sep 26-29)
NOVA Fall School 2006 (Dwingeloo, Netherlands; Oct 9-13)

Tran
Cosmic Frontiers (Durham, UK; Jul 31 - Aug 04)
'A Keck Spectroscopic Survey of MS1054: Assembling the Red Sequence'

Vermaas
Nederlandse Astronomen Conferentie (Ameland, Netherlands; May 10-12)
Dust and gas in ULIRGs (Cornell, USA; Jun 19-22)
NOVA Fall School (Dwingeloo, Netherlands; Oct 9-13)
'Starburst galaxies and ULIRGs in Near Infrared'

Visser
Chemistry of Planets (Glasgow, Scotland; Jan 5-6)
ISM/CSM Meeting (Amsterdam, Netherlands; Mar 15)
Faraday Discussion 133: Chemical Evolution of the Universe (St. Jacut de la Mer, France; Apr 24-26)
Modeling Polycyclic Aromatic Hydrocarbons in Circumstellar Disks: Chemistry and IR Emission Disks 2006 (Vidago, Portugal; Sep 18-23)

Modeling Polycyclic Aromatic Hydrocarbons in Circumstellar Disks: Chemistry and IR Emission PLANET Network meeting (Heidelberg, Germany; Oct 26-27)

de Vries
The Role of Black Holes in Galaxy Formation and Evolution (Potsdam, Germany; Sep 10-13)

Weijmans
SAURON team meeting (Oxford, UK; Jan 11-13)
VADER team meeting (Garching, Germany; Feb 3-5)
Nederlandse Astronomen Conferentie (Ameland, Netherlands; May 10-12)
SAURON team meeting (Garching, Germany; May 16-18)
The Fate of the Gas in Galaxies (Dwingeloo, Netherlands; Jul 12-14)
'Dark matter in NGC 2974: mapping the gas from 100pc to 10kpc scales'
Galactic Nuclei (Leiden, Netherlands; Jul 24-28)
IAU General Assembly (Prague, Tsjech Republic; Aug 14-25)
'Dark matter in NGC 2974: from 100pc to 10kpc scales'

van der Werf
'Gas and dust in ULIRGs' (Ithaca, USA; Jun 19-22)

Wiersma
Nederlands Astronomen Conferentie (Ameland, Netherlands, May 10-12)
CHEMODYNAMICS: From first stars to local galaxies (Lyon, France, Jul 10-14)
Kingston in Kingston: From Stars to Halos (Kingston, Canada, Jul 17-21)

Wuyts
Galaxy Evolution with Spitzer and Herschel (Agios Nikolaos, Crete; May 28 - Jun 2)
Cosmic Frontiers (Durham, UK; Jul 31 - Aug 4)

de Zeeuw
OPTICON FP7 Planning Meeting (Edinburgh, Scotland; Jun 22-23)
'Developing a Science Vision for Europe'
IAU General Assembly (Prague, Czech Republic; Aug 11-25)
'Developing a Science Vision for Europe'

'Concluding Remarks JD13: Exploiting Large Scale Surveys for Galactic Astronomy'
Lorentz Center Workshop on Nuclei of Galaxies; (Leiden, Netherlands, Jul 24-28
Lorentz Center Workshop on Dissecting the Milky Way; (Leiden, Netherlands, Nov 6-10)
'What of we had all GAIA data tomorrow?'

Appendix

VII

Observing sessions abroad

Observing sessions abroad

Appendix VII

Albrecht
ESO (Paranal Observatory, Chile; Aug 9-16)

Bottinelli
eSMA:SMA/JCMT/CSO (Mauna Kea, USA; Dec 12-13)
GBT (Green Bank, USA; Dec 26-Jan 8)

Brinch
Submillimeter Array (Mauna Kea, USA; Feb 14-21)

Geers
VLT-ISAAC & VISIR (Paranal, Chile; Apr 17-19)
VLT-VISIR (Paranal, Chile; May 3-8)

Hekker
IAC, TNG (La Palma, Spain; Jan 9)
Lick Observatory, CAT (San Jose, USA; Feb 20-25)
Lick Observatory, CAT (San Jose, USA; Apr 28 - May 3)
IAC, TNG (La Palma, Spain; May 17)
Lick Observatory, CAT (San Jose, USA; Aug 19-24)
Lick Observatory, CAT (San Jose, USA; Nov 13-18)

Israel
IRAM 30 m Telescope (Granada, Spain; Jul 4-10)

Jaffe
Cerro Paranal (Paranal, Chile, Sep 10-11)

Kriek
Gemini-South (Pachon, Chile; Jan 17-21)
Gemini-South (Pachon, Chile; Feb 21-25)
VLT (Paranal, Chile; Mar 1-3)
Gemini-South (Pachon, Chile; Dec 15-19)

van Langevelde
eSMA, JCMT (Mauna Kea, Hawaii USA.; Dec 16-17)

Lommen
SMA (Mauna Kea, USA; Oct 27-31)
eSMA (Mauna Kea, USA; Nov 7-8)

McDermid
WHT (La Palma, Spain; May 27 - Jun)

Miley
(Paranal, Chile; Nov 17-28)

Oliveira
Roque de los Muchachos Observatory 4.2m WHT (La Palma, Spain; May 4-5)
Roque de los Muchachos Observatory 3.58m TNG (La Palma, Spain; Jun 29 - Jul 1)

Panic
Submillimeter Array (Mauna Kea, Big Island, Hawaii, USA; Oct 30-Nov 06)

Röttgering
GMRT (Pune, India, Jan 10-18)
WHT (La Palma, Spain, Dec 12-17)

Salter
ESA's Zero-G Airbus A300 Microgravity Laboratory, 45th Parabolic Flight Campaign (Bordeaux, France; Oct 16-18)

van Scherpenzeel
Observatorio del Roque de Muchachos 4.2-m William Herschel Telescope (La Palma; Sep 13-23)

van Starkenburg
Observatory 1 (Paranal, Chile; Apr 17-18)

Torstensson
eSMA (Hilo, HI, USA; Dec 12-13)
JCMT (Hilo, HI, USA; Dec 15-18)

Tran
Magellan Observatory (La Serena, Chile; Feb 26 - Mar 1)

Visser
ESO-Very Large Telescope (Paranal, Chile; May 3-8)

Weijmans
William Herschel Telescope (La Palma, Spain; Feb 24-27)
Isaac Newton Telescope (La Palma, Spain; Apr 6-11)
William Herschel Telescope (La Palma, Spain; Sep 15-22)
3.5m Telescope (Calar Alto, Spain; Dec 22-26)

van der Werf
ESO (Paranal, Chile; Apr 7)
ESO (Paranal, Chile; Apr 17-18)
ESO (Paranal, Chile; Aug 15)

Appendix

VIII

Working visits abroad

Working visits abroad

Appendix VIII

Albrecht
MPI für Astronomie (Heidelberg, Germany; Nov 27 - Dec 02)

Beirao
Spitzer Science Center (Pasadena, USA; Jul 5-Dec 22)

Bottinelli
JCMT (Hilo, USA; Dec 8-11, 14-20)
Institute for Astronomy (Honolulu, USA; Dec 21-22)

Brandl
Observatoire de Geneve (Geneva, Switzerland; Feb 28 - Mar 2)
Spitzer Science Center (Pasadena, USA; Apr 26-29)
MIRI EC meeting (Copenhagen, Denmark; May 3-5)
IRS Team Meeting (Cornell/Ithaca, USA; Jun 22-24)
MIRI Software Meeting (Leuven, Belgium; Jul 17-19)
MIRI EC meeting (Madrid, Spain; Sep 25-28)
ELT DS Progress Meeting (Garching, Germany; Nov 8-9)

Brinch
Institut D'Astrophysique de Paris (Paris, France; Jan 15-29)
Institut D'Astrophysique de Paris (Paris, France; Jun 8-10)

Damen
Carnegie Observatories (Pasadena, USA; Apr 24 - May 7)
Yale University (New Haven, USA; Apr 3-24)
Carnegie Observatories (Pasadena, USA; Dec 9-20)

van Dishoeck
ESO (Garching, Germany; Jan 20)
University of Oxford (Oxford, UK; Feb 17)
Kyoto University (Kyoto, Japan; Mar 22)
University of Texas (Austin, USA; Apr 1-4)
Harvard Center for Astrophysics (Cambridge, USA; Apr 19-21)
Danish National Space Center (Copenhagen, Denmark; May 4)
Arizona State University (Flagstaff, USA; May 14-21)
MPI für Astronomie (Heidelberg, Germany; May 29)
Goddard Space Flight Center (Washington, USA; Jun 2)
ETH (Zürich, Switzerland; Jun 30)
Institute of Astronomy (Cambridge, UK; Jul 20-21)
Stockholm University (Stockholm, Sweden; Sep 13)
MPI für Radioastronomie (Bonn, Germany; Sep 26)
CSIC (Madrid, Spain; Sep 27-29)
LAOG (Grenoble, France; Oct 18)
MPI für Radioastronomie (Bonn, Germany; Oct 23)
CSIC (Madrid, Spain; Nov 13-17)
University of Milan (Milan, Italy; Dec 13)
University of Bologna (Bologna, Italy; Dec 14)

Franx
MPIA (Heidelberg, Germany; Feb 22-23)
Yale University (New Haven, USA, Apr 8-14)
Yale University (New Haven, USA; May 10-13)
University of California, Santa Cruz (Santa Cruz, USA, May 13-18)
MPIA (Heidelberg, Germany; Dec 11-13)

Geers
University of Texas, Austin (Austin, USA; Apr 21-28)
MPI für Astronomie (Heidelberg, Germany; Jun 20-23)

Haas
International Space Science Institute (Bern, Switzerland; Apr 3-9)

Hill
MPI für Radioastronomie (Bonn, Germany; Sep 26)
MPI für Radioastronomie (Bonn, Germany; Dec 13-15)

Hopman
Weizmann Inst. of Science (Rehovot, Israel; Sep 27 - Oct 9)

Israel
MPI für Radioastronomie (Bonn, Germany, Sep 26)
Editorial Board European Physics News (Stresa, Italy, Oct 21)

Jaffe
MPI für Radioastronomie (Bonn, Germany, Jan 11-12)
ESO (Garching Germany, Jan 25-27)
Observatoire de Nice, (Nice, France, Feb 6-7)
MPI für Astronomie (Heidelberg, Germany, Mar 12-13)
ESO (Garching Germany Apr 2-4)
MPI für Radioastronomie (Bonn, Germany, Apr 4-6)
Observatoire de Nice, (Nice, France, Nov 16-17)
MPI für Astronomie (Heidelberg, Germany, Nov 23-24)

Katgert
Osservatorio Astronomico (Trieste, Italy; Mar 5-13)
Osservatorio Astronomico (Trieste, Italy; Nov 22-Dec 1)

Koehler
ESO (Garching, Germany; Feb 14-16)
MPI für Astronomie (Heidelberg, Germany; Mar 13)
ESO (Garching, Germany; May 18-19)
ZAH, Landessternwarte Koenigstuhl (Heidelberg, Germany; Jun 7-8)
ZAH, Landessternwarte Koenigstuhl (Heidelberg, Germany; Jul 13)
MPI für Astronomie (Heidelberg, Germany; Sep 8)

Kriek
Yale University (New Haven (CT), USA; Jan 1-14)
Yale University (New Haven (CT), USA; Jan 22 - Feb 19)
Yale University (New Haven (CT), USA; Jun 5 - Jul 15)
Yale University (New Haven (CT), USA; Oct 15-29)

Kuijken
IAP (Paris, France; Feb 12-13)
MPE (Garching, Germany; Nov 27-28)

van Langevelde
MPI für Radioastronomie (Bonn, Germany; Mar 6-7)
ESO (Garching, Germany; Apr 6-7)
ESO (Garching, Germany; May 11)
PSNC (Poznan, Poland; Sep 25)
Torun Observatory (Torun, Poland; Sep 29)

ESO (Garching, Germany; Oct 23-24)
Joint Astronomy Centre (Hilo, Hawaii USA; Dec 6-18)

Linnartz
Institut für Nieder-Temperatur Plasmaphysik Greifswald (Greifswald, Germany, Jun)
University College Cork (Cork, Ireland, Sep)
Astronomical Institute, University Leuven (Leuven, Belgium, Dec)

Lommen
Center for Astrophysics (Cambridge, USA; Oct 17-23)
Joint Astronomy Centre (Hilo, USA; Nov 8-9)

McDermid
SAURON Team Meeting (Oxford, UK; Jan 11-13)
MUSE Science Team Meeting (Lyon, France; Mar 8)
MUSE Busy Week (Lyon, France; May 8-12)
SAURON Team Meeting (Garching, Germany; May 22-26)

Miley
ESO (Vitacura, Chile (Visiting Scientist); Feb 10)
ESO (Garching, Germany (Universe Awareness Committee); Feb 10)
MPI für Radioastronomie Fachbeirat (Bonn, Germany, Jan 30 - Feb 1)
NRAO Visiting Committee (Charlottesville, Va, USA; Feb 4-11)
NRAO Visiting Committee (Socorro, NM, USA; Feb 27 - Mar 4)
Space Telescope Science Institute (Baltimore, USA; Mar 16-24)
Universe Awareness ISC (Heidelberg University, Germany; April 4--5)
NRAO Visiting Committee (Charlottesville, Va, USA; Apr 16 - 20)
IAU Executive Committee (Prague Czech Republic; Aug 21-26)
ACS Science Team (Conference Center, Jackson Hole, USA; Sep 25-27)
ACS Science Team (JHU Baltimore, USA; Sep 27-29)

Oliveira
MPI für Astronomie (Heidelberg, Germany; Oct 30-31)

Overzier
MPI für Astronomie (Heidelberg, Germany; Feb 13-14)
MPA (Garching, Germany; May 6-13)

Panic
California Institute of Technology (Pasadena, California, USA; Nov 8-11)

Röttgering
Institute d'Astrophysique (Paris, France, Feb 28)
Caltech (Pasadena, USA, June 1 - Oct 1)
EU (Brussel, Belgium, Oct 27)
MPI (Heidelberg, Germany, Nov 24)

Salter
Technical University of Braunschweig, Institute for Geophysics and Extraterrestrial Physics (Braunschweig, Germany; Aug 1 - Oct 15)

Smit
Pontificia Universidad Católica de Chile (Santiago de Chile, Chile; Nov 28 - Dec 15)

Snijders
Observatoire de Geneve (Geneve, Switzerland; Feb 28 - Mar 3)
Institute for Astronomy (Honolulu, USA; Apr 7 - May 11)
Institute for Astronomy (Honolulu, USA; Nov 20 - Dec 15)

Stuik
ESO (Garching, Germany; Jan 19-20)
ESO (Garching, Germany; Feb 15-16)
ESO (Garching, Germany; Feb 22-23)
Observatoire de Lyon (Lyon, France; Mar 6-7)
Astrophysical Institute of Potsdam (Potsdam, Mar 8-10)
MPI für Astronomie (Heidelberg, Germany; Mar 23-24)
Observatoire de Paris (Paris, France; Mar 28-Apr 1)
ESO (Garching, Germany; Apr 27-28)
Observatoire de Lyon (Lyon, France; May 8-12)
ESO (Garching, Germany; May 18-19)
ESO (Garching, Germany; Jul 6-7)
ING (Santa Cruz de La Palma, Spain; Oct 19-22)
ESO (Garching, Germany; Oct 25-26)
ESO (Garching, Germany; Nov 22-23)
Observatoire de Marseille (Marseille, France; Dec 10-12)

Taylor
MPI für Astronomie (Heidelberg, Germany; Feb 22 - Mar 2)
Yale University (New Haven, USA; May 4-23)
Universidad de Chile (Santiago, Chile; May 23 - June 6)

Tran
Swinburne (Melbourne, Australia; Dec 9-12

Visser R.
MPI für Astronomie (Heidelberg, Germany; Aug 16-17)

Weijmans
Oxford University (Oxford, UK; Apr 24-28)

Van der Werf
MPI für Extraterrestrische Physik (Garching, Germany; Jan 9-10)
Observatoire de Geneve (Geneva, Switzerland; Mar 1-3)
ESO (Santiago, Chile; Apr 8-14)
MPI für Radioastronomie (Bonn, Germany; Sep 26)
Unversitätszentrum Univ. Innsbruck (Obergurgl, Austria; Oct 24-26)
Joint Astronomy Center (Hilo, Hawii, USA; Nov 28-29)
Institute for Computational Cosmology (Durham, UK; Dec 15)

Wuyts
Yale University (New Haven, USA; Apr 7-15)
Carnegie Observatories (Pasadena, USA; May 1-20)
Harvard-Smithsonian Center for Astrophysics (Cambridge, USA; Aug 6-26)

de Zeeuw
CNRS (Paris, France; Jan 10)
University of Oxford (Oxford, UK; Jan 11-13)
Institut d'Astrophysique Spatiale (Orsay, France; Jan 18)
ESA (Paris, France; Jan 19)
ESO (Garching, Germany; Jan 24)
STScI (Baltimore MD, USA; Feb 4-7)
Steward Observatory (Tucson, AZ, USA; Feb 16-17)
Large Binocular Telescope (Mt Graham, AZ, USA; Feb 18)
Ministry of Science (Berne, Switzerland; Feb 27-28)
ESO (Garching, Germany; Apr 5)
STScI (Baltimore MD, USA; Apr 25)
AURA (Bethesda, MD, USA; Apr 26-29)
ESA (Paris, France; May 3-4)
ESO (Garching, Germany; May 16-18)
ESO (Garching, Germany; Jun 6-7)
Royal Observatory (Edinburgh, UK; Jun 22-23)
ESO (Garching, Germany; Jul 20)
STScI (Baltimore MD, USA; Sep 10-12)

Montana State University (Bozeman, MT, USA; Sep 13-16)
Institut d'Astrophysique (Paris, France; Sep 20)
ISSI (Berne, Switzerland; Oct 18-19)
STScI (Baltimore MD, USA; Oct 30/Nov 1)
Astron. Dept. Univ. of Texas (Austin TX, USA; Nov 12-18)
Astronomy Department (Leuven, Belgium; Nov 24)
AURA (Washington, USA; Dec 11)
STScI (Baltimore MD, USA; Dec 12-13)

Appendix

IX

Colloquia given outside Leiden

Colloquia given outside Leiden

Appendix IX

Beirao
Star Formation, PAH, and Molecular Excitation in Starbursts: Arp 143 and M82
Spitzer Science Center, Pasadena, USA; Dec 19

Brandl
Star Formation in Galaxies
NOVA Fall School, Dwingeloo, Netherlands, Oct 11-13

Brinch
Modeling the L1489 IRS disk using a molecular excitation and radiative transfer method,
SAO - Hawaii, Hilo, USA; Feb 20

van Dishoeck
'From Molecules to Planets'
Physics Department, Oxford, UK; Feb 17
Idem
Royal Swedish Academy of Sciences, Stockholm, Sweden; Sep 13
'Spitzer Observations of Gas and Dust in Star- and Planet-forming Regions: Ice Cold and Steaming Hot'
University of Kyoto, Kyoto, Japan; Mar 22
Idem
Goddard Space Flight Center, Greenbelt, USA; Jun 2
Idem
ESTEC, Noordwijk, Netherlands; Jun 23
'Chemistry in Evolving Protoplanetary Disks'
University of Texas, Austin, USA; Apr 4

'From Molecules to Planets: Lindsay award lecture'
Goddard Space Flight Center, Greenbelt, USA; Jun 2
'Recent Results in Star- and Planet Formation: from Spitzer to ALMA'
University of Bologna, Bologna, Italy; Dec 14

Fuchs
Complex molecule formation on interstellar dust surfaces
Grosses Physikalisches Kolloquium, University of Cologne, Germany, Nov 21

Geers
PAHs in T Tauri Disks
University of Texas, Austin, USA; Apr 21

Hekker
Red giant star
Nijmegen, Netherlands; Feb 8

Hill
Examining the Evolutionary Sequence of Massive Star Formation
MPI für Radioastronomie, Bonn, Germany; Dec 14

Icke
Colloquium 'Radiation Hydrodynamics' en workshop 'Practical Hydrodynamics'
IAC, La Palma, Spain; Feb 19-22
'What if dark matter and dark energy exist?'
Fysica2006, NNV Leiden, Netherlands, Apr 28
'Wat is waarheid?'
Symposium Marie Curie, Nijmegen, Netherlands; May 17
'Bernard's Cosmic Stories'
Valencia, Spain; Jun 26-30
'Relativiteit vanaf Huygens tot voorbij Einstein'
Opening Studium Generale TUEindhoven, Netherlands; Sep 6
'De toekomst van het Heelal'
Toekomst in het Groot, UvA, Amsterdam, Netherlands; Sep 13
'Tessellations in the Universe'
Colloquium wiskunde, TUDelft (Abdoel), Delft, Netherlands; Oct 10
'What if dark matter and energy exist?'
Vereniging Technische Fysica, Kronig Lezing TUDelft, Netherlands; Nov 29
'Voids in the Universe'
KNAW Workshop, Amsterdam, Netherlands; Dec 12-15
SARA Superdag, Astrophysical radiation hydrodynamics; Dec 14

Kriek
'Clues on Massive Galaxy Formation at z~2.5 from NIR spectroscopy'
STScI, Baltimore (MD), USA; Oct 19
Idem
Caltech, Pasadena (CA), USA; Nov 27
Idem
UCSC, Santa Cruz (CA), USA; Nov 29
Idem
Carnegie Observatories, Pasadena (CA), USA; Dec 1
Idem
UCB, Berkeley (CA), USA; Dec 4
Idem
Princeton University, Princeton (NJ), USA; Dec 6
Idem
CfA, Cambridge (MA), USA; Dec 7
Idem
Gemini Observatory Southern Operations Center, La Serena, Chile; Dec 14

Kuijken
'Weak Lensing with KiDS'
MPE, Garching, Germany; May 9
'KiDS: Studying Dark Matter and Dark Energy with Light Rays'
UCLA, Los Angeles, USA; Oct 11

Lommen
'Studying the disks in young stellar objects with mm interferometry CfA'
Cambridge, USA; October 8
Idem
JAC, Hilo, USA; November 8

McDermid
'SAURON's View on the Realm of the Nebulae'
Kapteyn Institute, Groningen, Netherlands; Dec 9

Miley
'Universe Awareness, an international inspirational programme for disadvantaged children'
Vliegende Hollanders. Science and Technology Summit 2006, Amsterdam, Netherlands, Nov 15

Overzier
'Touring the large-scale structure from z=1 to z=6 with HST/ACS'
MPIA, Heidelberg, Germany; Feb 14
'HST/ACS observations of clusters and cluster progenitors at z=1-6',
MPA, Garching, Germany; May 12

Röttgering
'LOFAR: opening a window on the low frequency universe'
Cardiff University, Cardiff, UK, Feb 1
Idem
University of Bristol, Bristol, UK, Feb 2
Idem
Durham University, Durham, UK, March 20
'LOFAR: A new low-frequency radio telescope. New directions for studies of powerful radio galaxies as probes of distant proto-clusters'
NRAO, Socorro, New Mexico, Aug 29
Idem
NOAO/Steward Observatory, Aug 31
Idem
Arizona State University, Phoenix, USA, Sep 1
Idem
Carnegy Observatory, Pasadena, USA, Sep 12
Idem
Caltech, Pasadena, Sep 27

Schaye
'The Chemical Enrichment of the Intergalactic Medium'
Department of Astronomy, Nijmegen, Netherlands; Nov 27
Idem
Institut d'Astrophysique de Paris, Paris, France; Dec 8

Smit
'Weak Lensing with KIDS'
Pontificia Universidad Católica de Chile, Santiago de Chile, Chile; Dec 12

Snijders
'Young star clusters under the microscope: ground-based mid-infrared observations of the Antennae galaxies'
IPAC, Pasadena, USA, Nov 15
Idem
UCLA, Los Angeles, USA, Nov 16

Idem
Carnegie, Pasadena, USA, Nov 17
Idem
IfA, Honolulu, USA, Dec 8

Stuik
'Adaptive Optics: Heroes of Might and Magic'
UVA, Amsterdam, Netherlands; Sep 22

Tran
'The Origin of Early-type Galaxies in Rich Clusters'
Kapteyn Institute, Groningen, The Netherlands; Jan 30
'Stellar Assembly and Galaxy Evolution in the Distant Universe'
Astronomy Dept., University of Massachusetts, Amherst; Mar 8
'Galaxy Cluster Assembly and the Origin of Early-type Members'
Astrophysics Sub-Dept., University of Oxford, Jun 6
'Cosmic Collisions: Forming the Most Massive Galaxies in the Universe'
Physics Dept., Virginia Tech, Sep 1

van der Werf
Starburst galaxies at low and high redshift, ESO, Santiago, Chile; Apr 13

Wuyts
'Red Galaxies at z~2.5'
NOAO, Tucson, USA; Dec 1
'Idem'
Spitzer Science Center, Pasadena, USA; Dec 5
'Idem'
Yale, New Haven, USA; Dec 8
'Idem'
CfA, Cambridge, USA; Dec 12
'Idem'
STScI, Baltimore, USA; Dec 14

de Zeeuw
'SAURON & The Fossil Record of Galaxy Formation'
Radboud Universiteit, Nijmegen, Netherlands; Mar 11
'*Idem'*
Montana State University, Bozeman, MT, USA; Sep 15
'Idem'
Instituut voor Sterrenkunde, Leuven, Belgium; Nov 24

Appendix

X

Scientific publications

Sterrewacht Leiden

Scientific publications

Appendix X

X.1. Ph.D. Theses and Books

A. Blaauw and P. Katgert (ed.), Twee illustere theeplanters en het Leids Kerkhoven-Bosscha Fonds, 2006.

B. Jonkheid, Chemistry in evolving protoplanetary disks, Ph.D. thesis, Leiden University, June 2006.

I.L. ten Kate, Organics on Mars, Ph.D. thesis, Leiden University, January 2006.

P. Katgert, Ed., Twee illustere theeplanters en het Leids Kerkhoven-Bosscha Fonds

J.C. Mather, H.A. MacEwen, T. de Graauw, and W. M. Mattheus (eds.), Space Telescopes and Instrumentation I: Optical, Infrared, and Millimeter. Proceedings of the SPIE, Volume 6265, July 2006.

R. Meijerink, Models of the ISM in Galaxy Centers, Ph.D. thesis, Leiden University, November 2006.

R. Overzier, Emergence of cosmic structures around distant radio galaxies and quasars, Ph.D. thesis, Leiden University, May 2006.

S.-J. Paardekoper, Growing and moving planets in disks, Ph.D. thesis, Leiden University, September 2006.

D. Queloz, S. Udry, M. Mayor,W. Benz, P. Cassen, T. Guillot, and A. Quirrenbach (eds.), Extrasolar planets, 2006.

S. Solte and H. Linnartz (eds.), Special Issue: CAMOP-MOLEC XV, 2006.

X.2. Articles in Refereed Journals

J. M. Alcalá, L. Spezzi, A. Frasca, E. Covino, A. Porras, **B. Merín**, and P. Persi, The first brown dwarf with a disk in Chamaeleon II, *Astron. Astrophys.* **453**, L1–L4.

S. Andersson, **A. Al-Halabi**, G.J. Kroes and **E.F. van Dishoeck**, Photodissociation of water ice, *J. Chem. Phys.*, **124**, 064715-1--14

L. Armus, J. Bernard-Salas, H. W. W. Spoon, J. A. Marshall, V. Charmandaris, S. J. U. Higdon, V. Desai, L. Hao, H. I. Teplitz, D. Devost, **B. R. Brandl**, B. T. Soifer, and J. R. Houck, Detection of the Buried Active Galactic Nucleus in NGC 6240 with the Infrared Spectrograph on the Spitzer Space Telescope, *Astrophys. J.* **640**, 204–210.

J.-C. Augereau and H. Beust, On the AU Microscopii debris disk. Density profiles, grain properties, and dust dynamics, *Astron. Astrophys.* **455**, 987–999.

H. Baumgardt, **C. Hopman**, S. Portegies Zwart, and J. Makino, Tidal capture of stars by intermediate-mass black holes, *Monthly Notices Roy. Astr. Soc.* **372**, 467–478.

P. Beirão, **B. R. Brandl**, D. Devost, J. D. Smith, L. Hao, and J. R. Houck, Spatially Resolved Spitzer Spectroscopy of the Starburst Nucleus in NGC 5253, *Astrophys. J. Lett.* **643**, L1–L4.

A. M. Beloborodov, **Y. Levin**, F. Eisenhauer, R. Genzel, T. Paumard, S. Gillessen, and T. Ott, Clockwise Stellar Disk and the Dark Mass in the Galactic Center, *Astrophys. J.* **648**, 405–410.

L. Binette, R. J. Wilman, M. Villar-Mart´ın, R. A. E. Fosbury, **M. J. Jarvis**, and **H. J. A. Röttgering**, Ionization of large-scale absorbing haloes and feedback events from high-redshift radio galaxies, *Astron. Astrophys.* **459**, 31–42.

S. E. Bisschop, **H. J. Fraser**, **K. I. Öberg**, **E. F. van Dishoeck**, and **S. Schlemmer**, Desorption rates and sticking coefficients for CO and N2 interstellar ices, *Astron. Astrophys.* **449**, 1297–1309.

J. P. Blakeslee, B. P. Holden, **M. Franx**, P. Rosati, R. J. Bouwens, R. Demarco, H. C. Ford, N. L. Homeier, G. D. Illingworth, M. J. Jee, S. Mei, F. Menanteau, G. R. Meurer, M. Postman, and **K.-V. H. Tran**, Clusters at Half Hubble Time: Galaxy Structure and Colors in RX J0152.7-1357 and MS 1054-03, *Astrophys. J.* **644**, 30–53.

J. A. D. L. Blommaert, M. A. T. Groenewegen, K. Okumura, S. Ganesh, A. Omont, J. Cami, I. S. Glass, **H. J. Habing**, M. Schultheis, G. Simon, and J. T. van Loon, ISO mid-infrared spectroscopy of Galactic Bulge AGB stars, *Astron. Astrophys.* **460**, 555–563.

R. van den Bosch, **P.T. de Zeeuw**, K. Gebhardt, E. Noyola, and **G. van de Ven**, The Dynamical Mass-to-Light Ratio Profile and Distance of the Globular Cluster M15, *Astrophys. J.* **641**, 852–861.

T. L. Bourke, P. C. Myers, N. J. Evans, II, M. M. Dunham, J. Kauffmann, Y. L. Shirley, **A. Crapsi**, C. H. Young, T. L. Huard, T. Y. Brooke, N. Chapman, L. Cieza, C. W. Lee, P. Teuben, and Z. Wahhaj, The Spitzer C2D Survey of Nearby Dense Cores. II. Discovery of a Low-Luminosity Object in the "Evolved Starless Core" L1521F, *Astrophys. J. Lett.* **649**, L37–L40.

R. J. Bouwens, G. D. Illingworth, J. P. Blakeslee, and **M. Franx**, Galaxies at z ~ 6: The UV Luminosity Function and Luminosity Density from 506 HUDF, HUDF Parallel ACS Field, and GOODS i-Dropouts, Astrophys. J. 653, 53–85.

B. R. Brandl, J. Bernard-Salas, H. W. W. Spoon, D. Devost, G. C. Sloan, S. Guilles, Y. Wu, J. R. Houck, D. W. Weedman, L. Armus, P. N. Appleton, B. T. Soifer, V. Charmandaris, L. Hao, J. A. M. S. J. Higdon, and T. L. Herter, The Mid-Infrared Properties of Starburst Galaxies from Spitzer-IRS Spectroscopy, *Astrophys. J.* **653**, 1129–1144.

W. van Breugel, W. de Vries, S. Croft, C. De Breuck, M. Dopita, **G.Miley**, **M. Reuland**, and **H. Röttgering**, High redshift Ly_ halos, *Astronomische Nachrichten* **327**, 175–179.

C. Broeg, **V. Joergens**, M. Fernández, D. Husar, T. Hearty, M. Ammler, and R. Neuhäuser, Rotational periods of T Tauri stars in Taurus-Auriga, south of Taurus-Auriga, and in MBM12, Astron. Astrophys. 450, 1135–1148.

F. A. van Broekhuizen, **I. M. N. Groot**, **H. J. Fraser**, **E. F. van Dishoeck**, **and S. Schlemmer**, Infrared spectroscopy of solid CO-CO2 mixtures and layers, *Astron. Astrophys.* **451**, 723–731.

M. H. Brookes, P. N. Best, **R. Rengelink**, and **H. J. A. Röttgering**, CENSORS: A Combined EIS-NVSS Survey of Radio Sources - II. Infrared imaging and the K-z relation, *Monthly Notices Roy. Astr. Soc.* **366**, 1265–1288.

A. G. de Bruyn, **P. Katgert**, M. Haverkorn, and **D. H. F. M. Schnitzeler**, Radio polarization and RM structure at high Galactic latitudes, *Astronomische Nachrichten* **327**, 487–490.

B. A. Buckalew, H. A. Kobulnicky, J. M. Darnel, E. Polomski, R. D. Gehrz, R. M. Humphreys, C. E. Woodward, J. L. Hinz, C. W. Engelbracht, K. D. Gordon, K. Misselt, P. G. Pérez-González, G. H. Rieke, S. P. Willner, M. L. Ashby, P. Barmby, M. A. Pahre, T. L. Roellig, N. Devereux, J. T. Loon, and B. Brandl, Understanding Radio-selected Thermal Sources in M33: Ultraviolet, Optical, Near-Infrared, Spitzer Mid-Infrared, and Radio Observations, *Astrophys. J. Suppl. Ser.* **162**, 329–345.

L. M. Buson, **M. Cappellari**, E. M. Corsini, E. V. Held, J. Lim, and A. Pizzella, NGC 7679: an anomalous, composite Seyfert 1 galaxy whose X-ray luminous AGN vanishes at optical wavelengths, *Astron. Astrophys.* **447**, 441–451.

M. Cappellari, R. Bacon, M. Bureau, **M. C. Damen**, R. L. Davies, **P. T. de Zeeuw**, E. Emsellem, **J. Falcón-Barroso**, D. Krajnović, H. Kuntschner, **R. M. McDermid**, R. F. Peletier, M. Sarzi, **R. C. E. van den Bosch**, and **G. van de Ven**, The SAURON project - IV. The mass-to-light ratio, the virial mass estimator and the Fundamental Plane of elliptical and lenticular galaxies, *Monthly Notices Roy. Astr. Soc.* **366**, 1126–1150.

J. Cernicharo, J. R. Goicoechea, F. Daniel, M. R. Lerate, M. J. Barlow, B. M. Swinyard, **E. F. van Dishoeck**, T. L. Lim, S. Viti, and J. Yates, The Water Vapor Abundance in Orion KL Outflows, *Astrophys. J. Lett.* **649**, L33–L36.

M.-R. L. Cioni, L. Girardi, P. Marigo, and **H. J. Habing**, AGB stars in the Magellanic Clouds. II. The rate of star formation across the LMC, *Astron. Astrophys.* **448**, 77–91.

M.-R. L. Cioni, L. Girardi, P. Marigo, and **H. J. Habing**, AGB stars in the Magellanic Clouds. III. The rate of star formation across the Small Magellanic Cloud, *Astron. Astrophys.* **452**, 195–201.

M.-R. L. Cioni, L. Girardi, P. Marigo, and **H. J. Habing**, Erratum: AGB stars in the Magellanic Clouds. II. The rate of star formation across the LMC, *Astron. Astrophys.* **456**, 967–967.

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