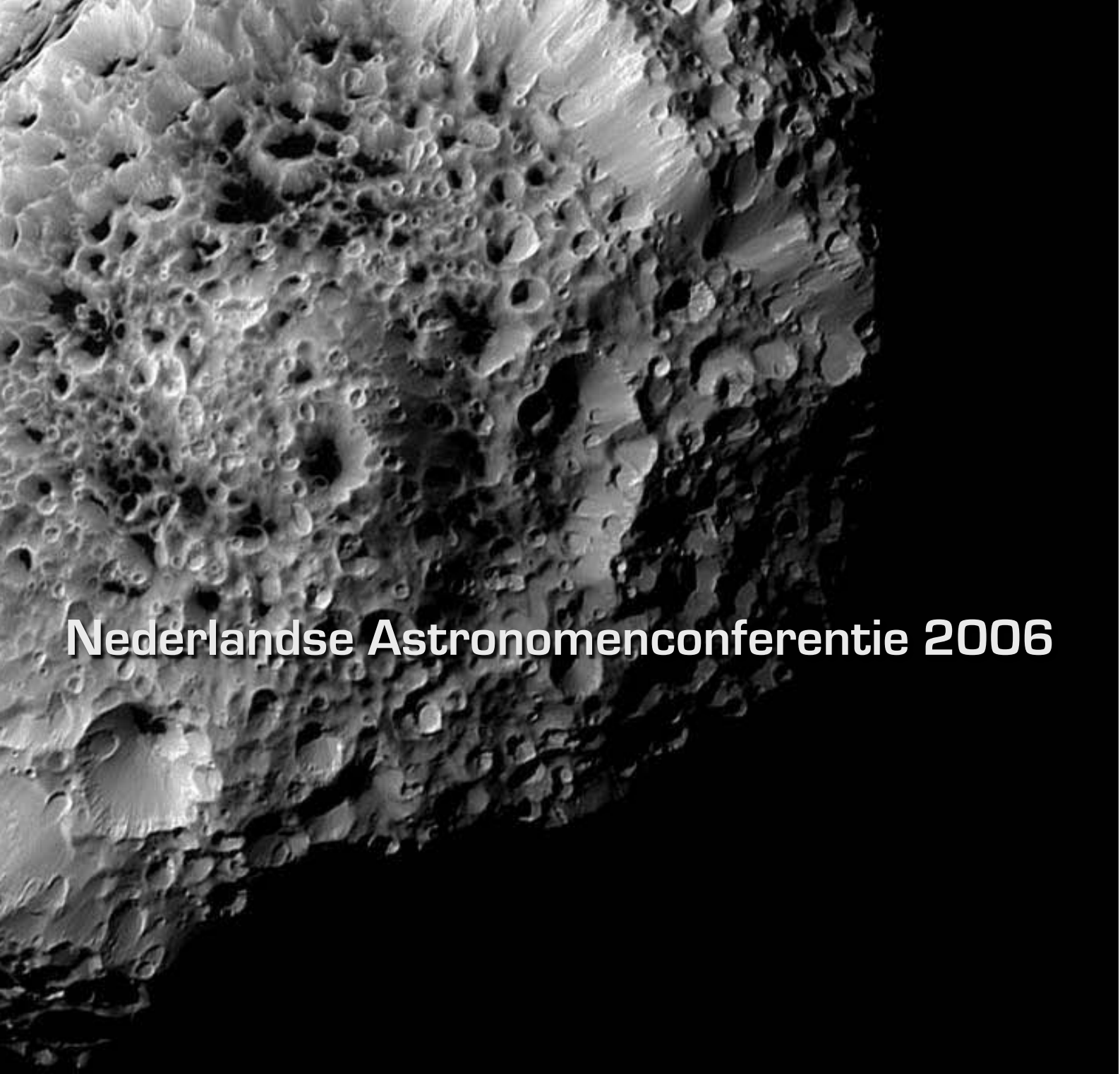

Nederlandse Astronomenconferentie 2006

Ameland
10-12 May 2006

nederlandse astronomenclub
Universiteit Utrecht
NOVA
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Netherlands Organisation for Scientific Research
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the language of science

61e Nederlandse Astronomenconferentie

Hotel d'Amelander Kaap

10–12 May 2006

Ons land is klein dat weet een ieder
Dat hebben we op school gehad
Maar het kan groot zijn in zijn schoonheid
Ik denk hierbij speciaal aan het Wad
De Zeeuwse Wateren zijn ook prachtig
Zoals in vele folders staat
Maar zij missen net dat wat het Wad heeft
En wat zich niet beschrijven laat

Als je bij eb door het kleffe Wad loopt
En de klei zich aan je zolen kleeft
Zie je het licht van de Brandaris
Dan besef je dat je leeft
Je loopt maar wat door het Wad te waden
En je houdt je kleren droog
Want je weet als straks de vloed komt
Gaan de broekspijpen omhoog

—Neerlands Hoop in Bange Dagen
'Wij moeten strijden voor de Wadden'

Introduction

Welcome to Ameland and to the 2006 Netherlands Astronomy Conference! The Wadden islands have been the location of the NAC several times before, and those who were there probably have special memories of those occasions. We are very pleased to organize this year's NAC on Ameland again, and we hope the beautiful setting will make up for the extra effort in travelling here.

We have put together what we think is an attractive programme of invited and contributed talks, including ample time for viewing the posters. In keeping with the NAC tradition, our main purpose is to allow students, postdocs and staff from the different institutes to meet and share their work in an informal atmosphere. This is helped along, we hope, by the social activities during the three meeting days – culminating in a walking trip back to the mainland over the fascinating mudflats of the Wadden Sea.

On behalf of the Astronomical Institute Utrecht and the Organizing Committee, we welcome you to Ameland and we look forward to an interesting and enjoyable conference!

Onno Pols

This conference was made possible with the financial aid of:

NWO - Netherlands Organisation for Scientific Research
NOVA - Netherlands Research School for Astronomy
Leids Kerkhoven-Bosscha Fonds
Springer Publishing

The 61st Nederlandse Astronomenconferentie is organized by the Astronomical Institute Utrecht.

Organizing committee:

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Location:

Hotel d' Amelander Kaap
Oosterhiemweg 1
9161 CZ Hollum - Ameland
Tel.: +31 (0)519 - 55 46 46

Programme

Wednesday 10 May

12:30		arrival d'Amelander Kaap, start registration	
13:00		buffet lunch	
14:30		opening of the NAC2006	
		Session I	
14:35–15:05	I	Leon Koopmans	
		Gravitational lensing and stellar dynamics: probing galaxy structure and evolution	p. 8
15:05–15:25	C	Olaf Wucknitz	
		Low-frequency VLBI observations of the gravitational lens 0218+357	p. 8
15:25–15:45	C	Klaas Wiersema	
		Properties of the ISM in galaxies at $z \sim 4$ from GRB afterglows	p. 9
15:45–16:30	C	Jelena Petrovic	
		Possibility for neutrino detection with LOPES/LOFAR	p. 9
16:05–16:30		coffee break and poster viewing	
16:30–16:50	C	Nanda Rea	
		Highly energetic RRATs populate the Universe	p. 10
16:50–17:10	C	Patrick Weltevrede	
		The extreme radio emission of PSR B0656+14	p. 10
17:10–17:30	C	Rob Rutten	
		Solar Balmer-alpha with the Dutch Open Telescope	p. 11
17:30–17:50	C	Dennis Bodewits	
		Diagnostics of cometary X-ray and Far-UV aurorae	p. 11
17:50–18:10	C	Andreas Nigl	
		Jupiter VLBI with LOFAR	p. 12
18:10		poster session and happy hour	
19:00		dinner	
20:30		evening social programme	

N = NOVA Keynote
I = Invited Review
C = Contributed Talk

Thursday 11 May

07:30		breakfast	
		Session II	
09:00–09:30	I	Yuri Levin	
		Young stars in the galactic center	p. 12
09:30–09:50	C	Else van den Besselaar	
		Proper motion selected white dwarf - red dwarf binaries	p. 12
09:50–10:10	C	Lex Kaper	
		The Guiness Book of neutron stars	p. 13
10:10–11:00	C	Cees Bassa	
		The mass of a millisecond pulsar	p. 13
10:30–11:00		coffee break and poster viewing	
11:00–11:50	N	Brad Gibson	
		The chemistry of the local group of galaxies	p. 14
11:50–12:10	C	Nick Cox	
		Diffuse interstellar bands: organic molecules in the Milky Way and beyond	p. 14
12:10–12:30	C	Michiel Hogerheijde	
		APEX detection of H2D+ in the starless core Barnard 68 (and why you should care)	p. 15
12:30		lunch and afternoon activity: beach volleyball tournament alternative: nature walk and climbing the lighthouse	
		Session III	
16:00–16:30	I	Gijs Nelemans	
		Compact binaries in the galaxy	p. 15
16:30–16:50	C	Manuel Linares	
		Accreting millisecond pulsars: X-ray variability from fast spinning neutron stars and their surroundings.	p. 16
16:50–17:10	C	Gijs Roelofs	
		The formation channel of the 17-minute binary AM Canum Venaticorum	p. 16
17:10–18:00	C	Saskia Hekker	
		Analysis of line profile variations of pulsating red giants	p. 17
17:30–18:00		coffee break and poster viewing	
18:00–18:20	C	Maria Lugaro	
		Presolar grains as a tool for stellar nucleosynthesis: the case of spinel grain OC2	p. 17
18:20–18:40	C	Evelien Vanhollebeke	
		Dust sequence along the AGB	p. 18
18:40–19:00	C	Vincent Icke	
		The sound of a tessellated star	p. 18
19:00		dinner	
20:30		poster prize award	
21:00		evening lecture: Peter Werkhoven – *The crosstalk between our senses*	
22:00		evening social programme	

Friday 12 May

07:30		breakfast	
		Session IV	
09:00–09:30	I	Søren Larsen	
		Extragalactic star clusters	p. 19
09:30–09:50	C	Paul Groot	
		The European Galactic Plane Surveys (EGAPS)	p. 19
09:50–10:10	C	Lisa Harvey-Smith	
		Finding the missing methanol masers in W3(OH)	p. 19
10:10–11:00	C	Mark Gieles	
		The role of spiral arms and giant molecular clouds in the disruption of star clusters	p. 20
10:30–11:00		coffee break and poster viewing	
11:00–11:50	N	Adam Burrows	
		New ideas in the theory of core-collapse supernova explosions	p. 20
11:50–12:10	C	Arend Jan Poelarends	
		Supernovae from massive AGB stars	p. 21
12:10–12:30	C	Alexander van der Horst	
		GRB 030329: 1000 days of radio afterglow monitoring and modeling	p. 21
12:30–12:50	C	Peter den Hartog	
		Extreme anomalous X-ray pulsars	p. 22
12:50		closing remarks	
13:00		lunch	
14:00		departure buses to ferry	
15:00		alternative: ‘wadlopen’ to the mainland	
19:00		arrival mudwalkers in Holwerd	

Posters

Talk Abstracts

A1 – Gravitational lensing and stellar dynamics: probing galaxy structure and evolution

L. Koopmans[1]

[1]Kapteyn Institute, Groningen

Strong gravitational lensing and stellar dynamics provide two complementary and orthogonal constraints on the density profiles of galaxies. I will show that the combination of both techniques is powerful in breaking the mass-sheet and mass-anisotropy degeneracies. I will then present observational results from the Lenses Structure & Dynamics (LSD) Survey and the Sloan Lens ACS (SLACS) Survey to illustrate this new methodology in constraining the dark and stellar density profiles, and mass structure of early-type galaxies to a redshift of unity.

Publication status:

Contact and/or more info: koopmans@astro.rug.nl

A2 – Low-frequency VLBI observations of the gravitational lens 0218+357

O. Wucknitz[1]

[1]JIVE, Postbus 2, 7990AA Dwingeloo

B0218+357 is one of the most interesting gravitational lens systems we know. Radio maps show two bright core images plus a highly structured Einstein ring, being caused by the multiply imaged and distorted jet of the background source. Recently the time delay of this system has been used to determine the Hubble constant with high accuracy. In this talk I present new observations which for the first time show the structure of the radio ring with VLBI techniques at high resolution. The data will be used to improve the lens models and to investigate effects of the ISM of the lensing galaxy on the radiation from the background source. The lens effect provides two images of one and the same background sources. Any differences not being explained by the lens effect must be due to differences in the ISM properties along the two lines of sight.

Publication status: *work in progress, unpublished*

Contact and/or more info: wucknitz@jive.nl

A3 – Properties of the ISM in galaxies at $z \sim 4$ from GRB afterglows

K. Wiersema[1]

[1]University of Amsterdam

The *Swift* satellites' combination of wide field of view and exceptional sensitivity has enabled an order of magnitude increase in the number of detected γ-ray bursts (GRBs), and has for the first time enabled the detection of bursts at $z > 6$, demonstrating the promise of GRBs as powerful probes of the IGM and star-formation in the very distant universe. By optimizing rapid response strategies on optical telescopes (eg VLT and WHT) we have successfully obtained high signal to noise, high resolution spectroscopy of GRB afterglows at very large distances ($z \sim 4$). We show how we use GRB afterglows as probes of small scale environments (star forming regions) in galaxies at high redshifts. As an example we report on measurements of density, abundances, velocities and the presence of hydrogen molecules in the immediate surroundings of two GRBs of the last year.

Publication status: *Wiersema et al in prep; Fynbo et al. 2006, astro-ph/0602444; Starling et al. 2005, A&AL, 442, 21*

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A4 – Possibility for neutrino detection with LOPES/LOFAR

Jelena Petrovic[1] **and LOPES collaboration**

[1]Department of Astrophysics, Radboud University, Nijmegen

LOPES - LOFAR PrototypE Station (LOFAR - LOw Frequency ARray) is an array of dipole antennas used for the detection of radio emission from cosmic ray air showers. It is co-located and triggered by the KASCADE (KArlsruhe Shower Core and Array Detector) experiment, which also provides information about air shower properties like electron number N_e, muon number N_μ, azimuth and zenith angle. LOPES-10 (the first phase of LOPES, consisting of 10 antennas) detected a significant number of cosmic ray air showers with a zenith angle larger than 50^o, and many of those have very high field strengths. The most inclined event that has been detected with LOPES-10 has a zenith angle of almost 80^o. This is important, because cosmic ray air showers with large inclinations, triggered close to the ground, would be a signature of neutrino events. Due to the small baseline of the LOPES-10 detector, it is not yet possible to determine accuratelly the radius of curvature of the showers front, which is related to the distance to the maximum of shower development. However, this should be possible in the future with a large baseline radio telescope like LOFAR.

Publication status:

Contact and/or more info: `petrovic@astro.ru.nl`

A5 – Highly energetic RRATs populate the Universe

N. Rea[1], M. McLaughlin[2], S. Reynolds[3], B. Gaensler[4], G.L. Israel[5], A. Possenti[6]

[1]SRON - Netherlands Institute for Space Research, NL
[2]Jodrell Bank Observatory, University of Manchester, UK
[3]North Carolina State University, USA
[4]Harvard-Smithsonian Center for Astrophysics, USA
[5]INAF-Astronomical Observatory of Rome, IT
[6]INAF-Astronomical Observatory of Cagliari, IT

The first neutron star was observed in 1968. Since then more than a thousand of neutron stars were discovered, but despite the single equation of state leading their existence, many different classes of neutron stars are known in our Galaxy, with highly different and puzzling observational properties. I first, very briefly, review all the different flavors of neutron stars we know thus far, I will then focus on the RRATS (Rotating RAdio Transients), a newly discovered class of sources, maybe another puzzling flavor in which the neutron stars are confusing us.
Astrophysical Journal Letter, in press
Contact and/or more info: N.Rea@sron.nl

A6 – The extreme radio emission of PSR B0656+14

P. Weltevrede[1], G.A.E Wright[2,1], B.W. Stappers[3,1], J.M. Rankin[4,1]

[1]Astronomical Institute “Anton Pannekoek”, University of Amsterdam, NL
[2]Astronomy Centre, University of Sussex, U.K.
[3]Stichting ASTRON, Dwingeloo, NL
[4]Physics Department, University of Vermont, USA

We present a detailed study of the single pulses of B0656+14, a radio pulsar known to be a strong pulsed source of high-energy emission. Despite the pulsar’s steady radio energy output in the radio band, the profile requires an unusually long timescale to achieve stability.
But what was most striking was that the pulsar occasionally exhibited exceptionally powerful (the brightest detected pulse is 116 times brighter than the average pulse) and longitudinally narrow subpulses reminiscent of “giant” pulses, hitherto reported for only a handful of pulsars, including famously the Crab pulsar and mostly young or millisecond pulsars. More recently, giant pulses have been discovered in two old pulsars. If their presence could be confirmed in B0656+14, it appeared that the phenomenon might be also found in pulsars of intermediate age and hence at any stage of a pulsar’s lifetime.
Publication status: *A&A, in press*
Contact and/or more info: wltvrede@science.uva.nl

A7 – Solar Balmer-alpha with the Dutch Open Telescope

J. Leenaarts[1], R.J. Rutten[1,2], M. Carlsson[2], H. Uitenbroek[3], and the DOT team[1]

[1]Sterrekundig Instituut, Utrecht, The Netherlands

[2]Institute of Theoretical Astrophysics, Oslo, Norway

[3]National Solar Observatory, Sunspot, USA

The Dutch Open Telescope (DOT) on La Palma started producing high-resolution movies of the solar atmosphere as sampled by the H I Balmer-alpha line in the autumn of 2004. This diagnostic is uniquely suited to study the magnetic topology and dynamics of the solar chromosphere, in particular when the observing samples large field of view at high angular resolution, long duration at high cadence, and the full wavelength span across the line with sufficient spectral resolution to disentangle source function, opacity, and Doppler modulations. The DOT achieves all these through speckle reconstruction of image sequences taken with a rapidly tuned Lyot filter. The resulting movies are spectacular. Quantitative interpretation is far from trivial but becomes feasible through sophisticated numerical modeling. Our first results from comparing DOT Balmer-alpha movies with 3D magnetoconvection simulations show, to our own surprise, that the wings of this chromospheric line furnish the best proxy magnetometer in the whole spectrum to isolate and track tiny magnetic elements in the deep photosphere.

Publication status: *A&A, paper & letter in press*

Contact and/or more info: `R.J.Rutten@astro.uu.nl, dot.astro.uu.nl`

A8 – Diagnostics of cometary X-ray and Far-UV aurorae

D. Bodewits[1], A.G.G.M. Tielens[2], R. Hoekstra[1]

[1]KVI atomic physics, Zernikelaan 25, NL-9747 AA Groningen, The Netherlands

[2]NASA Ames Research Center, MS 245-3, Moffett Field, CA 9435-1000, USA

Charge exchange occurs whenever ions collide with neutrals. Electrons are captured into excited states that subsequently decay to the ground state through the emission of one or more photons. Because charge exchange reactions are very sensitive to velocity and electron donor effects, the resulting emission can be regarded as a fingerprint of the underlying interaction.

In the solar system, charge exchange emission in X-ray and the far UV has been found on a large variety of objects that interact with the solar wind, such as comets, Mars and the interstellar medium. Recently, we developed a model for the charge exchange emission of comets, based upon measured charge exchange cross sections. This model demonstrates the diagnostic potential of charge exchange emission by analyzing existing EUVE, Chandra and XMM observations in terms of solar wind and coma characteristics. We conclude that clear spectral, temporal and morphological effects are detectable for different comet-solar wind conditions.

Publication status: *Bodewits et al., Ap.J. 642, 2006 (in press); Lisse et al., Ap.J. 635, p1329 (2005)*

Contact and/or more info: `bodewits@kvi.nl, www.kvi.nl/∼atf`

A9 – Jupiter VLBI with LOFAR

A. Nigl[1], **P. Zarka**[2], **J. Kuijpers**[1], **H. Falcke**[3]

[1]Department of Astrophysics, RU Nijmegen, 6535 ED Nijmegen, The Netherlands
[2]LESIA, CNRS/Observatoire de Paris, 92195 Meudon, France
[3]ASTRON, 7990 AA Dwingeloo, The Netherlands

Io-induced Jupiter emission lies mainly in the frequency range from about 2 to 40 MHz, which happens to coincide with the frequency band of the Initial Test Station of LOFAR (LOFAR/ITS). ITS is capable of measuring the radio signal with high time and frequency resolution, which makes it well-suited for the study of Jovian decametric emission (DAM). We present the first simultaneous Io-DAM observations of Jupiter at about 700 km distance between the two instruments, LOFAR/ITS (Exloo, The Netherlands) and the Nançay Decametric Array (NDA) (Nançay, France). We have detected emission from Jupiter during snapshots of a few seconds and identified detailed features down to milli-second time scales in dynamic spectra taken with both instruments. This article presents spectra and waveform cross-correlation to demonstrate the feasibility of Very Long Baseline Interferometry (VLBI) in the low frequency band of LOFAR. By adding remote stations to the LOFAR network at this baselines will provide the instrument with an arcsecond spatial resolution.

Publication status: *Astronomy & Astrophysics, in preparation*
Contact and/or more info: `anigl@astro.ru.nl, www.astro.ru.nl/anigl/`

A10 – Young stars in the Galactic Center

Y. Levin[1]

[1]Leiden Observatory

SgrA*, the supermassive black hole in the center of our galaxy, is surrounded by tens of young massive stars. Their location and kinematics point to a highly unusual birth and life history. We will present some ideas for the origin of these young stars, and connect these ideas with galactic nuclei in a more general context.

Publication status:
Contact and/or more info: `yuri@strw.leidenuniv.nl`

A11 – Proper motion selected white dwarf - red dwarf binaries

E.J.M. van den Besselaar[1], **T. Augusteijn**[2], **R. Greimel**[3], **P.J. Groot**[1]

[1]Department of Astrophysics, University of Nijmegen, The Netherlands
[2]Nordic Optical Telescope, Canary Islands, Spain
[3]Isaac Newton Group of Telescopes, Canary Islands, Spain

One of the main unknowns in binary evolution is the so-called common-envelope phase: a short lived phase during which the core of the giant and the companion star exist within one envelope. A product and good tracer of common-envelope evolution are detached close white dwarf + low-mass main-sequence (red dwarf) binaries. Their combined colours locate them in distinct regions of colour-colour diagrams. We have used a combination of proper motion and SDSS colours to distinguish between our targets and background quasars. We selected a very clean population of white dwarf - red dwarf binaries. We will investigate the orbital period distribution of these systems together with their characteristics to compare with results from population synthesis codes and set limits on the physics of the common-envelope phase.

Publication status: *Astronomy & Astrophysics, in preparation*
Contact and/or more info: `besselaar@astro.ru.nl, http://www.astro.ru.nl`

A12 – The Guiness Book of Neutron Stars

L. Kaper[1], A. van der Meer[1]

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Neutron stars are the compact remnants of massive stars with a central density as high as 5 to 10 times the density of an atomic nucleus. Until a few years ago the common perception has been that all neutron stars have a mass limited to a narrow range around 1.35 $M_\odot$. Recent accurate measurements of the masses of X-ray pulsars in high-mass X-ray binaries have shown that neutron stars have masses ranging from 1 to 2.5 $M_\odot$. This result has important consequences for the equation of state of matter at supra-nucear densities and for the formation mechanism of neutron stars, i.e. the supernova.

Publication status: *PhD thesis Arjen van der Meer, 2006, University of Amsterdam*

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A13 – The mass of a millisecond pulsar

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[2]Dept. of Astronomy and Astrophysics, University of Toronto, Canada

[3]Institut für Theoretische Physik und Astrophysik der Universität Kiel, Germany

We present spectroscopic and photometric observations of the optical counterpart to PSR J1911−5958A, a millisecond pulsar located towards the globular cluster NGC 6752. We measure radial velocities from the spectra and determine the systemic radial velocity of the binary and the radial-velocity amplitude of the white-dwarf orbit. Combined with the pulsar orbit obtained from radio timing, we infer the mass ratio of the binary. The spectrum of the counterpart is that of a hydrogen atmosphere, showing Balmer absorption lines upto H12, and we identify the counterpart as a helium-core white dwarf of spectral type DA5. Comparison of the spectra with hydrogen atmosphere models yield the white dwarf effective temperature and surface gravity. Using mass-radius relations appropriate for low-mass helium-core white dwarfs, we infer the white-dwarf mass and radius. Combined with the mass ratio, this constrains the pulsar mass to $M_{\rm PSR} = 1.40^{+0.16}_{-0.10}\,M_\odot$. If we instead use the white-dwarf spectrum and the distance of NGC 6752 to determine the white-dwarf radius, we find a larger radius and hence a lighter white dwarf. We find that the white-dwarf radius determined from the spectrum and the systemic radial velocity of the binary are inconsistent at the 1σ and 2σ level with the values that are expected if PSR J1911−5958A is associated with NGC 6752. We discuss possible causes to explain this inconsistency, but conclude that our observations do not conclusively confirm nor disprove the assocation of the pulsar binary with the globular cluster.

Publication status: *Submitted to A&A (`astro-ph/0603267`)*

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A14 – The Chemistry of the Local Group of Galaxies

B.K. Gibson[1]

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Numbering but a modest membership of perhaps 50 galaxies, our Local Group remains a unique laboratory for conducting the experiments which will ultimately lead us to an understanding of the physics underlying structure formation throughout the Universe. Our privileged vantage point within the Local Group makes this the only place in the Universe for which ”galactic archaeology” allows a potential star-by-star reconstruction of the dynamical, stellar, and chemical enrichment histories of complex composite systems such as our own Milky Way and its neighbouring satellites. Mining this ”fossil record” for clues to the history of galaxy formation is one of the most exciting topics in near-field cosmology today. Underpinning all such analyses of ”chemical fingerprinting” are the the stellar nucleosynthetic processes from which these fingerprints are derived. In my address to the NAC, I will attempt to give a current snapshot of this exciting, rapidly developing, research area, highlighting in particular the leadership role being played by the Dutch Astronomical community.

Publication status: *Astrophysical Journal, in press*

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A15 – Diffuse interstellar bands: organic molecules in the Milky Way and beyond

Nick Cox[1]

[1]Astronomical Institute “Anton Pannekoek”, Universiteit van Amsterdam

Diffuse interstellar bands (DIBs) are unidentified absorption bands, observed from the visible to the near-infrared, that originate in the diffuse interstellar medium. Although the first bands were already discovered in the 1920’s their identity remains elusive.

DIBs show a wide range of profiles. Substructure in some of these is indicative of large carbon molecules. Currently investigated DIB carrier candidates include polycyclic aromatic hydrocarbons and fullerenes.

The DIBs are ubiquitously present throughout the Milky Way. Recent studies revealed their presence in the Large and Small Magellanic Cloud, and even beyond in supernovae host galaxies NGC 1448 and NGC 4321. I will present recent results on the study of DIBs and carrier candidates in these different extra-galactic environments. These results show that DIB carriers are readily formed and distributed throughout the universe, surviving abundantly in the harsh diffuse ISM conditions. The local physical conditions govern the exact balance of formation and destruction.

Publication status: *PhD thesis, 2006, UvA, isbn: 90 5776 1521*

Contact and/or more info: `ncox@science.uva.nl, www.astrobiology.nl`

A16 – APEX Detection of H_2D^+ in the Starless Core Barnard 68 (And Why You Should Care)

M.R. Hogerheijde[1], Paola Caselli[2,3], Martin Emprechtinger[4], Floris van der Tak[5], João Alves[6], Nikolaus Volgenau[4], Martina Wiedner[4]

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[2]Arcetri, Italy
[3]Harvard-Smithsonian Center for Astrophysics, Cambridge MA, USA
[4]I. Physikalisches Institut, Universität zu Köln, Germany
[5]SRON-Groningen, Netherlands
[6]European Southern Observatory, Germany

In the densest and coldest parts of interstellar molecular clouds, deuterium-carrying isotopes of many molecules are greatly enhanced, sometimes by three or four orders of magnitude. At the heart this phenomenon lies the exchange reaction $HD + H_3^+ \leftrightarrow H_2D^+ + H_2$, which at low temperatures runs only in the forward direction. This traps deuterium in H_2D^+, which, like H_3^+, plays a pivotal role in the formation of many molecules. Using the newly commissioned Atacama Pathfinder EXperiment (APEX) telescope, we have detected H_2D^+ in a dark cloud core, Barnard 68. Detecting H_2D^+ is not easy because its line lies near a very opaque part of the atmosphere, and high and dry sites like Chajnantor are required. Barnard 68 is a very well studied starless core, and we show that the detected line strength and extremely narrow line width agrees quantitatively with the chemical and dynamical state of this globule.

Publication status: *Astronomy & Astrophysics, in press*

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A17 – Compact Binaries in the Galaxy

Gijs Nelemans[1]

[1]Department of Astrophysics, IMAPP, Radboud University Nijmegen

Binaries play an important role in our Galaxy. More than half of the objects in the sky are binaries, but more importantly, their evolution leads to many spectacular phenomena, such as supernovae, gamma-ray bursts and gravitational-wave sources. Much progress has been achieved in our understanding of binary evolution and the associated physics from studying individual objects and single populations. However, many aspects are still lacking, in particular the complex interaction between the stars in phases of (unstable) mass transfer. At the same time sky surveys mapping large parts of the Galaxy are becoming available. The next step forward will be to construct models of many Galactic binary populations simultaneously which can be directly compared to these surveys. I'll describe the astrophysical questions we want to answer, the progress that has been made and discuss our future plans.

Publication status:

Contact and/or more info: nelemans@astro.ru.nl, www.astro.ru.nl/∼nelemans

A18 – Accreting millisecond pulsars: X-ray variability from fast spinning neutron stars and their surroundings.

M. Linares[1], **M. van der Klis**[1], **R. Wijnands**[1], **D. Altamirano**[1]

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Millisecond X-ray pulsations were discovered by Wijnands & van der Klis (1998) in the transient low-mass X-ray binary (LMXB) SAX J1808.4–3658. Since then six additional systems have been found to harbor such accreting millisecond pulsars (AMPs), allowing better comparison with "common", non-pulsating neutron star LMXBs. The observed (and defining) pulsations in AMPs prove that the neutron star in these systems has a $10^8 - 10^{10}$ G magnetic field, a fundamental physical quantity that still remains elusive in the rest of neutron star LMXBs. We report our results on the aperiodic timing and color behavior of two AMPs, XTE J1807–294 and IGR J00291+5934, using RXTE data. In the former we discovered pairs of simultaneous kilohertz quasi-periodic oscillations separated by the spin frequency and a shift in the frequency-frequency correlations when comparing them to other neutron star LMXBs (Linares et al. 2005). The latter is the fastest AMP (it spins ~ 600 times every second) and showed an exceptional behavior during its 2004 outburst as to aperiodic X-ray variability: extremely high variability and distributed at very low frequencies, something that has been typically associated with black hole candidate LMXBs and that might be due to a combination of strong magnetic field and fast spin (Linares et al. 2006).

Publication status:
Linares, M., van der Klis, M., Altamirano, D. & Markwardt, C. B. 2005, ApJ, 634, 1250.
Linares, M., Wijnands, R. & van der Klis, 2006, ApJ, to be submitted.
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A19 – The formation channel of the 17-minute binary AM Canum Venaticorum

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The AM CVn stars form a distinct class of ultra-compact binaries: two interacting white dwarf-like objects in orbits as short as five minutes. Although rare, they are thought to be the end-products of several binary stellar evolution scenarios, which makes them unique laboratories for testing binary evolution theory. They are further of interest for the emerging field of gravitational-wave astronomy, being the predominant sources of gravitational waves in the *LISA* frequency regime.
Combining *HST* and ground-based observations, we recently discovered that the mass-losing star in the prototype binary AM Canum Venaticorum is much more massive than previously thought. This makes AM CVn the first object of the class for which we can reconstruct its evolutionary history. I will discuss the important implications for AM CVn's formation channel, and for its importance as a *LISA* test source.
Publication status: *MNRAS, submitted*
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A20 – Analysis of line profile variations of pulsating red giants

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So far, red giant oscillations have been studied using radial-velocity and/or light curve variations, which reveal frequencies of the oscillation modes. To characterise radial and non-radial oscillations, line profile variations are a valuable diagnostic. Here we present for the first time a line-profile analysis of pulsating red giants. The main difficulties encountered are the small line profile variations and the predicted short damping and re-excitation times in red giants.
Two line diagnostics have been tested to see whether these are sensitive to the small line profile variations present in red giants. In addition, line profiles are simulated with short damping and re-excitation times and compared with the observations.
The comparison between the observations and simulations reveals that non-radial modes are most likely to be visible in the line profile variations while theory predicts the occurrence of radial modes.
Publication status: *Astronomy and Astrophysics, in prep.*
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A21 – Presolar Grains as a Tool for Stellar Nucleosynthesis: the Case of Spinel Grain OC2

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Presolar dust grains were born around ancient stars, ejected into the interstellar medium, preserved during the formation of the solar system, and trapped inside primitive meteorites from where they are now extracted and analysed. Their isotopic compositions are extremely anomalous with respect to those found in the bulk of the solar system material. They represent a detailed record of the composition of their parent stars, and, as such, a major constraint for the study of the origin of the elements in stars. As an example, we present the composition of spinel ($MgAl_2O_4$) grain OC2. High excesses of the heavy Mg isotopes are present in this grain and thus an origin from an intermediate-mass asymptotic giant branch (AGB) star was proposed for it. We compare the composition of grain OC2 to detailed models of AGB stars. We discuss our candidate models for the parent star of grain OC2 and the constraints that we can derive on nuclear reaction rates and stellar models.
Publication status: *in preparation*
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A22 – Dust sequence along the AGB

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[8]Mt. Stromlo

The evolution of stars on the Asymptotic Giant Branch (AGB) is characterized by substantial mass loss, producing large amounts of circumstellar dust and a dust-driven outflow, which injects the stellar ejecta into the interstellar medium. We observed a homogeneous sample of AGB stars in the Galactic Bulge with Spitzer-IRS from 5.2 to 38 μm with the aim to study the variations in dust composition for 1.5 solar mass stars as they evolve along the AGB. The Spitzer-IRS wavelength range, 5.2-38 μm, contains the major spectral features of aluminum oxides, spinel, magnesium-iron oxides as well as those of amorphous and various crystalline silicates. Previous studies have shown these components to be abundant in AGB environments, albeit with highly varying relative abundances. The stars in our sample all originate from 1.5 solar mass stars, and only differ in their ages along the AGB. Moreover, this sample fully covers the range in AGB mass-loss rates, from the onset of mass loss on the AGB up to the superwind phase.
Publication status: *in preparation*
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A23 – The sound of a tessellated star

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The scale height in stars with extended atmospheres is comparable to the stellar radius. Thus, if such a star is convective – as they usually are – the number of major convective cells is likely to be small. Accordingly, the motion of the outer layers may be modelled as a two-dimensional array of coupled oscillators. For various reasons the Voronoi Tessellation is a plausible prescription for making such a tessellation. This enforces a specific equation of motion for the coupled oscillators, a 2D analogue of the well-known Fermi-Pasta-Ulam chain. I will present some numerical solutions of this equation, and some general analytic properties that might be observable in long time series.
Publication status: *This is it*
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A24 – Extragalactic Star Clusters

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Research in star clusters has traditionally focussed on two main aspects: 1) The role of clusters as a (the?) fundamental mode of star formation (e.g. how many stars form in clusters? How many of the young embedded clusters surve as bound entities?) 2) Using clusters as tracers of stellar populations in galaxies that are too far away for individual stars to be resolved. However, until recently developments in these two areas have been somewhat decoupled. In this talk I will review some of the (in my view) important questions yet to be resolved, such as whether star clusters really are good tracers of star formation. I will also discuss some of the research I have been involved in over the past few years, of which one of the main aims has been to establish the relation between the massive star clusters observed in an ever increasing diversity of environments, and the old "classical" globular clusters typically associated with the spheroidal components of galaxies.

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A25 – The European Galactic Plane Surveys (EGAPS)

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The European Galactic Plane Surveys is a collaboration of surveys that combined will image for the first time ever the full Galactic plane ($360^\circ \times 10^\circ$) in the optical u', g', r', i' and $H\alpha$ down to 21st magnitude using the INT+Wide Field Camera and the VST+Omegacam. The red northern survey, IPHAS, started in 2003 and an overview of the first results will be shown. Combined EGAPS (with a proposed nIR and UV extension) will detect 1 billion objects, 1% of all the stars in the Galaxy

Publication status: *Drew, J., et al., 2005, MNRAS 362, 753*

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A26 – Found: Missing methanol masers in W3(OH)

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We present the first MERLIN maps of methanol masers since the installation of the new e-MERLIN 4-8 GHz receivers. The short and long baselines of MERLIN has allowed us to study the extended maser emission in the massive star forming region W3(OH). We have consequently discovered a vast 'filament' of extended maser emission in both hydroxyl and methanol surrounding the ultra-compact HII region. The filament stretches 3500 au across the face of W3(OH) and has a linear velocity gradient. We can also report an underlying filamentary structure in the other methanol masers in the source, which challenges the current view of masers as VLBI-spots. By studying the velocity structure, line profiles and extended methanol maser emission we believe that we have located the position of the central star and also detected a circumstellar disc with a large velocity gradient of 47 km/s kpc. Future EVN+MERLIN observations will hopefully resolve this disc structure and allow us to understand better the size and rotation rate.

Publication status: *MNRAS, in press*

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A27 – The role of spiral arms and giant molecular clouds in the disruption of star clusters

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[2]University of Amsterdam, The Netherlands

We study the effect of passages of spiral arm density waves and giant molecular clouds (GMCs) on the evolution of star clusters. With N-body calculations we simulate star clusters in different environments, such as the solar neighborhood and spiral galaxies with various spiral arm strengths and GMC densities. For the disruptive effect of spiral arm passages we find a strong dependence on the location of the cluster with respect to the corotation radius of the galaxy. The vicinity of the Galactic corotation radius to the solar neighborhood make spiral arms contribute significantly to the dissolution of Galactic open clusters. We derive disruption times for clusters with various masses and radii due to GMCs encounters based on the mass loss derived from the N-body simulations. The combined effect of the galaxy tidal field, a realistic stellar mass function and stellar evolution following from earlier studies was hitherto not able to explain the observed disruption time of star clusters in the solar neighborhood and the central region of M51. We show that the additional disruptive effect of spiral arms and GMC passages can explain the (observed) age distributions and disruption times of clusters in the solar neighborhood and M51, respectively.

Publication status: *MNRAS, in prep (GMCs)*
Publication status: *MNRAS, submitted (Spiral arms)*
Publication status: *A&A, 441, 949 (M51 clusters)*
Publication status: *A&A, 441, 117 (Solar neighborhood clusters)*
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A28 – New Ideas in the Theory of Core-Collapse Supernova Explosions

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I will discuss a new mechanism for core-collapse supernova explosions that relies upon acoustic power generated in the inner core as the driver. In our recent 2D simulations, a strong advective-acoustic oscillation with a period of 25-30 milliseconds (ms) arises 200 ms after bounce. Its growth saturates due to the generation of secondary shocks, and kinks in the resulting shock structure funnel and regulate subsequent accretion onto the inner core. However, this instability is not the primary agent of explosion. Rather, it is the acoustic power generated in the inner turbulent region and most importantly by the excitation and sonic damping of core g-mode oscillations. An l=1 mode with a period of 2-4 ms grows to be prominent around 500 ms after bounce. The accreting protoneutron star is a self-excited oscillator. The associated acoustic power seen in our current simulations is sufficient to drive the explosion. The angular distribution of the emitted sound is fundamentally aspherical. The sound pulses radiated from the core steepen into shock waves that merge as they propagate into the outer mantle and deposit their energy and momentum with high efficiency. The core oscillation acts like a transducer to convert accretion energy into sound. An advantage of the acoustic mechanism is that acoustic power does not abate until accretion subsides, so that it is available as long as it may be needed to explode the star. I will address the consequences of this new mechanism for supernova explosions, the r-process, pulsar kicks, supernova blast morphology, and the gravitational radiation signatures of the deaths of massive stars.

Publication status:
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A29 – Supernovae from massive stars

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We present new computations of the final fate of massive AGB-stars. These stars form ONeMg cores after a phase of carbon burning and are called Super AGB stars (SAGB). Detailed stellar evolutionary models until the thermally pulsing AGB were computed using three different stellar evolution codes. The subsequent evolution was modeled by a synthetic code with different options for mass loss rate and dredge-up efficiency. We find a range of initial masses between $9.0\,\mathrm{M}_\odot$ and $9.25\,\mathrm{M}_\odot$ for which we expect an SAGB star to explode as an electron capture supernova. Our models allow a detailed assessment of the envelope properties of electron-capture supernova progenitors. SAGB stars with lower initial masses are the progenitors of ONeMg white dwarf, while more massive stars ignite (off-center) neon burning and follow the classical core-collapse path.

Publication status: *ApJ, in preparation*

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A30 – GRB 030329: 1000 Days of Radio Afterglow Monitoring & Modeling

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Radio observations of gamma-ray burst afterglows provide essential information on the physics of relativistic blastwaves powering these extreme phenomena. Observations at centimetre wavelengths allow us to obtain physical parameters like the total burst energy and the circumburst medium density, by completing the spectral energy distribution and following the behaviour of the blastwave until much later times than any other wavelengths. We have performed a monitoring campaign with the Westerbork Synthesis Radio Telescopes of GRB 030329, the brightest radio afterglow ever detected and still visible for over 1000 days after the burst. From our observations, combined with observations of other wavelengths, we can determine the physical parameters and examine the jet nature of the relativistic outflow. The blastwave is now in the non-relativistic regime of its evolution, giving us an excellent opportunity to determine the true total kinetic energy.

Publication status: *Van der Horst, A.J. et al. 2005, ApJ, 634, 1166*

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A31 – Extreme Anomalous X-ray Pulsars

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[5]McGill University Physics Department, Montreal, Canada

Anomalous X-ray Pulsars (AXPs) are young isolated rotating neutron stars which are discovered as strange sources in the soft X-ray band (0.5–10 keV). They are called anomalous, because they emit much more energy than can be inferred from their rotational energy losses due to spin down. AXPs have extremely high magnetic fields (inferred from the periods and period derivatives) of the order of $10^{14} - 10^{15}$ Gauss. The Magnetar model is the currently (most) accepted model that explains the very high X-ray luminosity induced by magnetic-field decay.
Until recently AXPs were never detected above 10 keV, but this view has changed drastically since they were discovered in hard X-rays. Nowadays we have seen AXPs up to $\sim$200 keV with INTEGRAL. The spectra of the so far detected AXPs show extremely hard power-law tails. In this talk we will present the new developments (and new problems) in AXP research at hard X-rays.

Publication status: *Astronomy and Astrophysics, in press and new work to be submitted*
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Poster Abstracts

P1 – A giant planet orbiting the pre-main-sequence star HD 100546?

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[2]ESO, Garching, Germany

The B9.5V star HD 100546 is an intriguingly old young star: the estimated age of this object is 10 Myr or more. The dust disk, which is believed to be cleared out after 10 Myr in young stellar systems, is still strikingly present. In this poster, we summarize the pecularities of the HD 100546 system including the presence of a gap in the dust disk at about 10 AU, the comet-like infrared spectrum of the target, the large-scale spiral-arm structure in the disk and the temporal variability of gaseous emission lines emanating from the disk's surface. We argue that the presence of a 20 $M_{\rm Jupiter}$ companion at a distance of $5-10$ AU to the central star might explain the deviating behaviour of this source compared to other young star+disk systems.

Publication status: *Based on Acke & van den Ancker 2006, A&A 449, 267*

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P2 – Edge-on Disk Galaxies in the Near-Infrared

O.A. van den Berg[1], **R.F. Peletier**[1], **M. Pohlen**[1]

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The aim of this research is to study the radial and vertical distribution of stars in disk galaxies using surface photometry, focusing on thick disks. Thick disks are a faint and extended stellar component, containing the oldest disk stars, so they are likely to trace the early stages of galaxy formation and evolution. To do this about 10 edge-on disk galaxies were observed in the *J* and/or *K'*-band with the 3.5-m Calar Alto or the 4-m UKIRT telescope. We use NIR images because those are much less contaminated by the absorbing dust in the mid-plane when doing structure analysis. We have developed an IRAF package used for data reduction to obtain images with extremely flat and low noise backgrounds. We show here colour and surface brightness profiles as cuts parallel to the minor and the major axis of the disk, searching for a thick disk component.

Publication status: –

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P3 – Interstellar scintillation as a probe of microarcsecond-scale structure in quasars and the local ISM

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[4]University of Sydney, Australia

A significant fraction of all flat-spectrum, extragalactic radio sources exhibit flux density variations on timescales of a few days or less at GHz frequencies due to interstellar scintillation (ISS). Observations of ISS can be used to probe very compact, microarcsecond-scale structure in the AGN, as well as properties of turbulence in the local Galactic ISM. A few quasars have been found to show unusually rapid, intra-hour variations (IHV), evidently due to scattering in very nearby, localized turbulent plasma. For these sources, it is relatively easy to study the ISS in detail as the scintillation pattern is well sampled in a typical observing session. The recent large-scale MASIV VLA Survey showed that such rapid ISS is extremely rare, and thus monitoring over much longer periods is required to study the ISS of most quasars in similar detail. I will discuss some methods and problems for using ISS as a probe of quasar structure, and also present some recent results for the IHV quasar PKS 1257-326.

Publication status: *Bignall et al. 2006, ApJ submitted*

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P4 – Population synthesis of s-enhanced stars

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S-process (slow neutron capture) elements are produced in the inter-shell zone of the thermally pulsating asymptotic giant branch stars. Their (relative) abundances depend on the exposure of heavy seed nuclei to free neutrons mostly produced out of the $^{13}\mathrm{C}(\alpha, n)^{16}\mathrm{O}$ reaction. We study the s-process element abundance ratios in stars by carrying out stellar population synthesis, using a rapid synthetic stellar evolution code which includes an up-to-date treatment of AGB nucleosynthesis and evolution. In contrast to other studies, we find that a large spread in the neutron exposure is not needed to explain the observed spread in the ratios of heavy s-process to light s-process elements ([hs/ls]), but this comes naturally from the range of different initial stellar masses and their time evolution. In the same fashion we also study the [Pb/Ce] ratios of lead stars and find that for low metallicities the neutron exposure is somewhat smaller.

Publication status: *in preparation*

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P5 – Gaia: the new EADS-Astrium design and plans for data processing

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Early this year EADS-Astrium was selected as the prime contractor for the Gaia mission and funding for the mission was fully approved by the science programme committee of ESA. In the new spacecraft design all functions – astrometry, photometry and the radial velocity spectrograph – are combined in a single telescope-focal-plane combination and the photometry is now obtained from low resolution spectra created with the aid of prisms. I will discuss the details of the new design and the expected scientific performance of the Gaia mission. In addition I will discuss the status of the Gaia data processing consortium and the Dutch and Belgian roles therein.

Publication status:

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P6 – Multipole Vectors and Low Quadrupole in Closed Flat Spaces

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The shape of the universe is usually considered to be a finite hypersphere or an infinite Euclidean or hyperbolic space. There are however more possibilities that are often overlooked. Standard cosmology, derived from Einsteins general relativity, is a differential theory which only defines the curvature of space, but not its topology. It is possible that the universe folds back into itself and is multi-connected, even with a non-positive curvature. We investigate flat orientable topological shapes of the universe and study their imprint on the cosmic microwave background. Although locally isotropic, these spaces can have preferred directions. The CMB anisotropies can be described by directional multipole vectors (Copi, Huterer, Starkman 2004). Our findings are that the low multipole moments will be suppressed or enhanced by certain topological shapes and that the multipole vectors will often align themselves parallel with or perpendicular to one of the main axes of a multiconnected universe.

Publication status: *Graduation Thesis*

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P7 – Amplification of radio emission from cosmic ray air showers in thunderstorms

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Radio flashes of cosmic ray air showers have been measured with LOPES (LOFAR Prototype Station), an array of LOFAR radio antennes co-located with the KASCADE air shower array in Karlsruhe. The dominant radiation mechanism can be described as coherent geosynchrotron emission from electron-positron pairs. We have investigated the influence of atmospheric electric fields on the radio emission analytically and experimentally. It is found that radio pulses recorded during thunderstorm conditions are often stronger than pulses from similar showers under less severe weather conditions. Two mechanisms may be responsible for this amplification: acceleration of the relativistic electron-positron pairs in the shower or acceleration of unrelativistic ionization electrons left behind by the shower. The absence of amplification for most weather conditions makes radio detection of air showers a reliable method for determining the energy of the primary.

Publication status: *Astronomy & Astrophysics, in preparation*

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P8 – Approach of a Grand Solar Minimum and Effect on our Climate

Prof. Dr. Dirk K. Callebaut[1]

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The latitudes of the boundaries of the large-scale unipolar magnetic field regions make a jump to lower latitudes after polar reversal and then oscillate a bit around these so-called rest-latitudes until a new cycle starts. These rest-latitudes show a steady decrease during the last 12 cycles: for the higher ones from 53^o to 37.5^o and for the lower ones from 29.5^o to 16.5^o (averaging), north and south. The lower ones are approaching the limiting 11^o, corresponding to the limiting maximum Wolf number 40, below which no polar reversals happen and which may be taken as defining a grand minimum. Using an extrapolation we expect next grand minimum to occur at cycle 26 or just after it.
Seven other arguments contribute to belief this hypothesis. Some counter arguments are give too.
It is expected that a grand minimum may give a decrease of about 1 K on Earth, although this will partially be masked by the increasing atmospheric pollution and the corresponding global warming. This slightly reduced temperature may give the wrong impression that the present high temperatures are just a fluctuation and hence that one may further increase the pollution. That would be disastrous. Moreover, after a grand minimum (say about 5 cycles) we may expect to recover the lost 1 K with catastrophic results.

Publication status:

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P9 – Evolution of the circumstellar bubble around massive stars

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We simulate using a hydrodinamical code the evolution of the circumstellar buble around 12 solar masses star.From the model we take the wind mass loss,the wind velocity and we compute this parameters in order to get the evolution of a circumstellar bubble into the interstellar medium.The evolution of the star is followed until the presupernova stage.The most important moment in the star's evolution is when it reaches critical rotation during the so called "blue-loop" because the wind itself becomes anizotropic.

Publication status: *in preparation*

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P10 – Multiwavelength Afterglow of GRB 060124 P10 – The bright, long-lasting gamma-ray burst GRB 060124

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On 2006 January 24 a bright gamma-ray burst triggered instruments on *Swift*, Konus-Wind & HETE II. *Swift* immediately slewed to the burst and started observing in X-rays, ~ 350s *before* the main period of activity. An accurate position was disseminated rapidly via the Gamma-ray bursts Coordinates Network (GCN), which allowed for an optical counterpart to be detected 1 hour after the burst. At a redshift of $z = 2.297$ this was an extremely bright, long lasting burst.

Here we present our reduction & analysis of multi-wavelength data of the burst, including X-ray, γ-ray and optical observations of both the early, prompt emission phase of the burst, and the later, afterglow phase. The prompt X-ray emission displays well resolved flaring behavior, with spectral evolution – indicative of central engine activity – which allows us to estimate the energy ejection time for each flare. The otherwise smooth optical & X-ray afterglows demonstrate achromatic breaks at about 1 day which is consistent with a "jet break" in the fireball model of GRBs.

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P11 – Liberal or Conservative: Mass transfer in close massive binaries

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The efficiency of mass transfer is one of the big uncertainties in binary evolution. By comparing observations of double-lined eclipsing binaries with a large grid of stellar evolution models we found indications that even relatively non-violent case A mass transfer (with both stars on the main sequence) for systems with an O or B type primary is non-conservative.

Publication status: *masterthesis, article in preparation*

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P12 – Interferometric evidence for the binary nature of silicate J-type C-stars, IRAS18006-3213

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We present high spatial resolution VLTI/MIDI data on the silicate J-type carbon star IRAS18006-3213. In the most widely accepted hypothesis, silicate J-type C-stars are binary objects for which the dusty silicate emission originates from a circumbinary or circumcompanion disc. Observations were carried out with baselines ranging from 45 m to 100 m allowing a good coverage in u,v space. All observations resolved the object and show the very compact nature of the N-band emission around the C-rich AGB star ($\sim$ 30 mas). In addition, the highest spatial resolution data show a significant phase jump around 8.5 μm in the spectral direction. This shows that the AGB star is not centered on the silicate dust emission. We interpret this as strong direct evidence for the binary nature of these objects. We therefore constructed a model representing the AGB giant as a point source and the silicate emission as a uniform elliptical disc. We show that this simple model reproduces the observations well. With the data we have now, we cannot differentiate between the only two possible geometries: a disc around the binary or a disc around the companion (companion distance $\sim$ 60 mas).

Publication status: *A&A, in prep*

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P13 – An asteroseismic study of the β Cephei star β Canis Majoris.

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We present a spectroscopic study of the β Cephei star β Canis Majoris. Hundreds of high-resolution spectra were gathered during 4.5 years and the Si III line profiles centered on 4560 Å were subjected to a detailed line profile analysis. We searched for oscillation frequencies in different line diagnostics, compared them with those known from photometric studies and concluded the presence of three frequencies in our dataset: $f_1 = 3.97933\,\mathrm{c\,d^{-1}}$, $f_2 = 3.99959\,\mathrm{c\,d^{-1}}$ and $f_3 = 4.1832\,\mathrm{c\,d^{-1}}$, which were already found earlier from photometric data. By means of the moment method and from amplitude and phase variations across the profiles we could identify two of the modes as $(\ell_1, m_1) = (2, 2)$ and $(\ell_2, m_2) = (0, 0)$. We present our first results of modelling based on the oscillation frequencies in order to place constraints on the mass, age and core overshooting of this massive evolved β Cephei star.

Publication status: *A&A, in preperation*

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P14 – Tidal spin-up of Wolf-Rayet stars: A possible Gamma-Ray Burst progenitor?

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We investigate Wolf-Rayet star progenitor models for gamma-ray bursts, in the context of the collapsar model. Our goal is to see if tidal interaction of a Wolf-Rayet star with a compact object in a binary system can spin-up the Wolf-Rayet sufficiently, so that it forms a collapsar, thus triggering the formation of a gamma-ray burst. We use a 1-D hydrodynamic stellar evolution code to model the evolution of close Wolf-Rayet (WR) binaries, including magnetic fields, mass loss, rotation and chemical mixing. Our models show that if tidal spin-up works it leads to Roche-lobe overflow of the WR star or a merger of both stars. Also the tidal spin-up scenario favors gamma-ray burst production at low metallicity.

Publication status:

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P15 – Stellar Evolution of Collision Products

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One of the problems in understanding dense stellar systems is understanding what happens when single stars or binary stars systems undergo a close encounter. In some cases, such an encounter can lead to the collision and merging of two stars. The merging itself is a hydrodynamical process but understanding the further evolution of the remnant is a stellar evolution problem. The main difficulty from a computational point of view is to translate the hydrodynamics output in proper stellar evolution input. We believe we have found an algorithm to do this and present a few evolution tracks for such collision products.

Publication status:

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P16 – A maximum star cluster mass in the disk of M51

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The mass of the most massive cluster in a galaxy usually is determined by the cluster initial mass function (CIMF) and the star cluster formation rate (via the total number of clusters). It is becoming clear, though, that there might exist a fundamental upper cluster mass limit. We want to show that the interacting galaxy M51 shows the signs of an upper mass limit, which varies with position in the disk. By comparing observed and simulated luminosity functions (LFs) of cluster populations we can infer the underlying CIMF. A physical upper mass limit for star clusters will appear as a bend in the LF, if the star cluster formation rate is high enough to sample the full range of cluster masses. The location of the bend in the LF provides information about the value of the upper mass limit. Using the LF of the star cluster population of M51 we show that the cluster initial mass function is likely to be truncated at the high mass end. We also show that the maximum possible cluster mass in the central regions of the galaxy is higher than in the outskirts. Regions of higher background intensity also tend to form more massive clusters.
Publication status: *Astronomy & Astrophysics, in prep.*
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P17 – Binary Evolution Channels explaining the subdwarf B star PG1336-018

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SdB stars are core-helium burning stars ($\sim$0.5 $M_\odot$) with an extremely thin hydrogen envelope ($<$0.02 $M_\odot$). A large fraction of sdB stars is found in binaries. This suggests that Roche lobe overflow can effectively remove almost the entire hydrogen envelope near the tip of the first giant branch. To test this and other models, a detailed investigation of the sdB interior structure is necessary. Luckily, sdB stars have been observed to pulsate in heat-driven oscillation modes in agreement with theoretical expectations. Thus, asteroseismology provides an excellent tool to test the outcome of sdB formation channels. The work we present here is a first step in this direction and concerns a study of the range of fundamental parameters of progenitors of the sdB pulsating eclipsing binary PG 1336-018. Our results will constitute a fruitful starting point for our future seismic work on this star which will be based on high-precision VLT photometry and spectroscopy of this target star.
Publication status:
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P18 – A low mass brown dwarf companion in the eclipsing cataclysmic variable SDSS J1501+55 from S-Cam fast photometry

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We observed cataclysmic variable SDSS J1501+55 with the S-Cam Superconducting Tunnel Junction based detector on the 4.2m William Herschel Telescope.

We have fitted a model of two spheres, one radiating uniformly, one eclipsing the first, to the lightcurves observed. Combining the model parameters with radial velocity measurements from the Sloan digital sky survey's spectrum of the accretion disk yields the system parameters.

The mass of the secondary resulting from these measurements is below the critical mass for hydrogen burning of $0.08\,M_{\odot}$, making it one of very few systems observed consisting of a white dwarf and a brown dwarf.

Publication status: *submitted*

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P19 – PDR-Produced HI in Star-Forming Regions of M81 and M83

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We report our findings on the volume densities of H_2 in Giant Molecular Clouds (GMCs) associated with photodissociation regions (PDRs) in the nearby galaxies M81 and M83. In many instances, patches of HI are found close to bright FUV sources, as is expected for PDRs. The detected PDRs, in which dissociating photons dominate the radiation field, are larger than presently-well-studied PDRs in the Galaxy and have sizes of ≈ 100 parsec. The complexes of young, hot stars giving rise to these PDRs create a 'blanket' of photodissociated HI.

The balance equation governing the photodissociation process needs the ultraviolet luminosity incident on the surface of the GMC and the local dust-to-gas ratio together with the HI column density in order to calculate the volume density of molecular hydrogen.

As PAHs are also thought to trace star formation, and their MIR emission comes mostly from PDRs, we use this property to confirm the presence of PDRs near FUV sources. We present the statistics of this comparison and our findings as to what extent we are really seeing large scale PDRs in nearby galaxies. We outline our plans to extend this work in the coming year, including progress on our current work on M33.

We used recent radio data kindly provided by the THINGS group, David Thilker and Robert Braun, Galex UV data and Spitzer IRAC data.

This work is funded by STScI's Director's Discretionary Research Fund.

Publication status: *PhD thesis progress report*

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P20 – Window To The Stars

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We present a graphical user interface to the popular *TWIN* stellar evolution code. It removes the drudgery associated with the traditional approach to running the code, while maintaining the power, output quality and flexibility a modern stellar evolutionist requires.
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P21 – Glitch observations in slow pulsars

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We have analyzed 5.5 years of timing observations of 7 "slowly" rotating radio pulsars, made with the Westerbork Synthesis Radio Telescope. We present improved timing solutions and 30, mostly small, new glitches. Particularly interesting are our results on PSR J1814−1744, which is one of the pulsars with similar rotation parameters and magnetic field strength to the Anomalous X-ray Pulsars (AXPs). Although the high-B radio pulsars don't show X-ray emission, and no radio emission is detected for AXPs, the roughly similar glitch parameters provide us with another tool to compare these classes of neutron stars. Furthermore, we were able to detect glitches one to two orders of magnitude smaller than before, for example in our well-sampled observations of PSR B0355+54. We double the total number of known glitches in PSR B1737−30, and improve statistics on glitch sizes for this pulsar individually and pulsars in general. We detect no significant variations in dispersion measure for PSRs B1951+32 and B2224+65, two pulsars located in high-density surroundings. We discuss the effect of small glitches on timing noise, and show it is possible to resolve timing-noise looking structures in the residuals of PSR B1951+32 by using a set of small glitches.
Publication status: *submitted toA&A*
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P22 – Which binaries evolve into Be/X-ray systems?

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Be/X-ray binaries consist of a neutron star and a M(ain)S(equence) star, spun up by previous mass transfer. Due to this mass transfer the MS star is rotating at or very near its critical rotation. The centripetal force resulting from this rotation is strongest near the equator, where an outflow disk is formed. The compact star moves through this disk, accreting mass and producing X-rays at its surface.
The aim of my master research is to find out for what initial binary parameters a Be/X-ray binary is formed. These parameters include initial primary mass, mass ratio and period. As an important first step I looked at binaries consisting of a Be star and a helium star, in particular the system ϕ Persei. These binaries are thought to be an intermediate phase, before the helium star evolves into a compact star resulting in the final Be/X-ray binary. Various models with different initial parameters were compared to the above mentioned system. The models that fitted this system show a narrow distribution in initial parameters depending on the efficiency of the mass transfer.
Publication status:
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P23 – Air shower simulations for Lofar

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The new Lofar telescope is believed to be sensitive to radio emission from cosmic ray air showers. Proof of this was established using an array of Lofar test antennas coinciding with an existing air shower experiment. In order to connect these recent experimental results to the underlying phenomena, a series of air shower simulations are run using the existing air shower code *Corsika*. Lofar's future main computing facility, the IBM supercomputer Stella, is used to build a library of air shower events, which can be used to investigate their predicted radio emissions.

Publication status:

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P24 – The photometric evolution of dissolving star clusters

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The broad-band photometric evolution of unresolved star clusters of different metallicities is calculated in a simplified way, including the preferential loss of low-mass stars due to mass segregation. The stellar mass function of a cluster evolves due to three effects:
(a) stellar evolution with mass loss
(b) tidal effects before cluster-wide mass segregation reduce the mass function homogeneously, i.e. independently of the stellar mass;
(c) after mass segregation has finished, tidal effects preferentially remove the lowest-mass stars from the cluster.
We calculate the photometric evolution of star clusters, taking these effects into account. The evolution of the colours is different from that of "standard" cluster evolution models. The neglect of the loss of low mass stars may lead to errors in the age determinations of star clusters, and to errors in the star formation histories derived from cluster samples.

Publication status: *A&A, in press*

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P25 – Circumstellar Medium of Gamma-Ray Burst Progenitors

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Since long gamma-ray bursts are thought to occur when certain massive stars collapse to a black hole, the gamma-ray bursts are surrounded by the circumstellar medium that evolved during the life of the star. The circumstellar bubble shows up in gamma-ray burst observations in two ways:
1) Certain gamma-ray bursts have distinct, blue-shifted absorption lines in the spectrum of their afterglows. These absorption lines are the result of stellar wind interactions that occurred during the life of the star.
2) The afterglow of a gamma-ray burst is created when the gamma-ray burst jet sweeps up the surrounding matter to relativistic velocity. Therefore the lightcurve of the afterglow gives us information about the density distribution of the circumstellar matter.
We have made models of the circumstellar medium of massive stars and compared those to the observations, in order to determine the nature and previous evolution of gamma-ray burst progenitors.
Publication status: *NAC 2005*
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P26 – Surveying the Galaxy looking for variable sources

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We present the V band variability analysis of the point sources in the Faint Sky Variability Survey on time scales from 24 minutes to tens of days. We find that about one percent of the point sources down to V = 24 are variables. We discuss the variability detection probabilities for each field depending on field sampling, amplitude and timescale of the variability. The combination of colour and variability information allows us to explore the fraction of variable sources for different spectral types. We find that about 50 percent of the variables show variability timescales shorter than 6 hours. The total number of variables is dominated by main sequence sources. The distribution of variables with spectral type is fairly constant along the main sequence, with 1 per cent of the sources being variable, except at the blue end of the main sequence, between spectral types F0–F5, where the fraction of variable sources increases to about 2 percent. For bluer sources, above the main sequence, this percentage increases to about 3.5.
Publication status: *Submitted to MNRAS*
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P27 – Data processing for LOFAR Core Station 1

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LOFAR is the new LOw Frequency ARray that is presently under construction in the northern part of The Netherlands. In the middle of this year Core Station 1 (CS1) comes on-line. CS1 initially consists of 96 Low Band Antennas (30 MHz - 90 MHz) distributed over 4 LOFAR station sites. With CS1 it will be possible to test the full data pipeline from the antenna receptors to correlation on the Blue Gene supercomputer. The correlated data will be Flagged, Self-Calibrated and Imaged. The resulting data products serve as input for the User Software of the LOFAR Key Science groups. This presentation reports on the status of the different modules of the data reduction chain. In particular, the approach for the Self-Calibration module will be explained.

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P28 – Collisional evolution of dust aggregates

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It is commonly accepted that planets form by collisional growth of dust. Initially small, micron sized particles stick together forming aggregates with open structure. That initial stage where the dust growth occures via a hit and stick mechanism is driven by the Brownian motion of solid particles well coupled to the gaseous disk. At later stages, as the dust grains grow, the gas influence on their motion decreases and the relative velocities increase. The fluffy dust aggregates start to collide at higher velocities, which at first leads to restructuring. More energetic collisions cause strong compaction of aggregates and even higher energies cause destruction. Our understanding of these proceses is only qualitative and the quantitative description can not be applied to the protoplanetary disk models. In order to change this situation we use the N-body dynamics SAND code which models the collisions of the dust aggregates by calculating the contact forces between single dust grains. Our goal is to explore a large parameter space and formulate the quantitative description of dust collisions. Currently we are running numerous simulations of the dust collisions. The preliminary results present how the structure and size of the aggregates is affected at different velocities and for different porosity of the particle. We also show that when the aggregates are destroyed, the size distribution of the small fragments is described by a power law with the slope related to the collisional energy.

Publication status: *Work in progress*

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P29 – The red optical afterglow of GRB 030725

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We present a photometric study of the optical counterpart of the long-duration GRB030725. An optical counterpart was identified at the Bronberg Observatory about 7 hours after the burst occurred. The optical afterglow (OA) was observed between 4 and 15 days after the burst with the 1.54m Danish telescope at La Silla. We fit a broken power law to the data and determine a break time in the light curve between 16 hours and 4.7 days after the first detection. The decay slope is $\alpha_1 = -0.59^{+0.59}_{-0.44}$ before and $\alpha_2 = -1.43 \pm 0.06$ after the break. A bump may be present in the light curve, only significant at the 2σ level, 13.9 days after the burst. The spectral slope of the OA, measured 12 days after the burst, is -2.9 ± 0.6 , i.e. it falls in the extreme red end of the distribution of previous OA spectral slopes. Observations of the field 8 months after the burst with the NTT telescope (La Silla) resulted in an upper limit of $\mathrm{R_c}$=24.7 mag for the host galaxy of GRB030725.

Publication status: *A&A 439, 527-532, 2005*

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P30 – The lack of strong DIBs in post-AGB stars: are PAHs really the DIB carriers?

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Diffuse Interstellar Bands (DIBs) are broad absorption lines of interstellar origin that are seen in the spectra of reddened objects. The carriers of these DIBs are still not known, but polycyclic aromatic hydrocarbons (PAHs) are amongst the most probable candidate carriers. Due to the severe mass loss in the preceding AGB phase, post-AGB stars are often enshrouded by carbon-rich circumstellar dust, causing severe reddening. Therefore, post-AGB stars are ideal testlabs to search for possible circumstellar DIBs, and their dependence on (circum)stellar parameters. In this study, a systematic search for DIBs in high-resolution spectra of post-AGB stars is performed. Such a search requires detailed spectral syntheses, in order to disentangle genuine DIBs and stellar photospheric lines. Also, a precise knowledge of the interstellar and circumstellar reddening is required, to distinguish DIBs of circumstellar and DIBs of interstellar origin. Our study is still in progress, but a first result is that much weaker DIBs are seen (if any) than expected, and therefore we believe that their carriers are not present in the post-AGB circumstellar dust, or that they are not excited.

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P31 – Search for a bar in the center of M51

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In recent HST-ACS observations, it looks like there is a bar-like structure in the center of M51, the whirlpool galaxy. It is possible to determine from the color distribution what the intrinsic color of a certain region would be, and therefore to correct for extinction in that area. It then becomes possible to look at M51 as it would appear if there were no extinction, and a possible bar should be more apparent.
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P32 – Plasma flows around magnetic obstacles in solar wind

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It is very important to describe the plasma parameter distributions in the vicinity of magnetic clouds and other stable structures in solar wind. Assuming that the magnetic field around the object is determined or measured, the velocity fields can be calculated from the frozen-in equation. The plasma density and pressure are then given by explicit formulas expressing p and ρ as functions of only **B** and **V**. Clearly, an alternative is to solve the full system of MHD equations numerically. But even in this case such analytical estimates would be also of use when formulating initial and boundary conditions. It is shown in recent numerical simulations and data analyses that the area in front of magnetic clouds is important from the point of view of the geo-efficiency of the magnetic cloud which has a very complicated magnetic and plasma structure. For a detailed analysis of generic phenomena of magnetic clouds and particular features of individual clouds, it is necessary to treat these structures in terms of analytical functions. First, the velocity and magnetic field distributions satisfying specific boundary and frozen-in conditions are determined. Next, the plasma density and pressure are calculated. In this way, three-dimensional distributions are found for the case of an inclined cylindrical cloud.
Publication status: *manuscript in preparation*
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P33 – Radio observations of candidate magnetic O stars

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The magnetic Ap/Bp stars have a non-thermal radio spectrum caused by synchrotron emission from electrons in the stellar wind. Some O stars are also suspected to have a (weak) magnetic field, since cyclical variability is observed in their UV wind lines. The timescale of this variability is similar to their estimated rotation period, and can be well explained by a weak magnetic field of $\sim$100 Gauss. Directly detecting magnetic fields of hot stars with optical spectropolarimetry has proven to be very difficult. However, a non-thermal radio spectrum in one of these candidate magnetic O stars, is most probably produced by synchrotron emission which requires the presence of a magnetic field. We present results from archive VLA and new WSRT radio observations of five candidate magnetic O stars.
Publication status: *Astronomy and Astrophysics, in preparation*
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P34 – Asteroseismology of the β Cephei star KP Per

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We investigate the oscillations of the β Cephei star KP Per (HD 21803) based on high-quality multicolour Geneva photometry. 338 measurements spread over 1014 days were gathered with the Mercator telescope at La Palma. A detailed analysis reveals the frequencies $f_1 = 4.95573\,\mathrm{cd}^{-1}$, $f_2 = 5.04832\,\mathrm{cd}^{-1}$ and $f_3 = 3.40067\,\mathrm{cd}^{-1}$ and a candidate frequency $f_4 = 2.95058\,\mathrm{cd}^{-1}$.
We perform a mode identification by means of photometric amplitude ratios. Both f_1 and f_2 unambiguously correspond to dipole ($\ell = 1$) modes. The degrees of f_3 and f_4 seem to be $\ell = 2$ respectively $\ell = 1$, but the observational support for this is not very strong.
We also present the first results of a seismic modelling. We deduce that f_1 and f_2 belong to the same triplet. Assuming that f_1 and f_4 are zonal ($m = 0$) dipole modes, we find stellar models that reproduce and excite the observed frequencies. These models enable us to complete the mode identification and determine a range for some stellar parameters such as the mass, the radius and the overshoot parameter of KP Per.

Publication status: *A&A, in preparation*
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P35 – The evolutionary state of embedded Class I YSOs in rho Oph

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Disentangling the evolutionary stages of young stellar objects is key to piecing together the processes of star formation and the conditions that favour it. Classifying these sources based on their observed SED profile (Class 0, I, II or III) is an assumed indication of their evolutionary state. However, this photometric diagnostic tool is easily susceptible to distortions due to environmental properties, geometric orientation and varying conditions around the embedded protostar. Left unaccounted for, these effects can confuse formation scenarios and statistical information on a particular evolutionary stage. Here we use JCMT submillimeter continuum images and spectral line observations, Spitzer data and 2-D radiative transport calculations to constrain the geometrical properties, physical structure and evolutionary state of a sample of Class I YSOs in the rho Ophiucus core. The goal is a better understanding of the similarities and differences of objects sharing a characteristic Class I SED. For example, some sources are low-mass versions of the Class 0 protostars whereas other sources are Class II pre-main sequence stars with disks seen edge-on.

Publication status: *M.Sc. Thesis, expected in June 2006*
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P36 – The formation and evolution of the entire star cluster population of M51

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The new Hubble Heritage *ACS* mosaic of M51 gives us new and outstanding possibilities to study the formation and evolution of star clusters. We study the entire star cluster population in the disk of M51. We see evidence for an increased cluster formation rate at the point of co-rotation, where the rotation speed of the spiral arms is equal to the orbital speed. We also find evidence for a universal preferred radius for both young and old cluster populations.

M51 is a face-on spiral galaxy with a very rich cluster population because of its interaction with NGC 5195. Only with the *HST/ACS* it is now possible to resolve most star clusters ($\sim$6000) throughout the entire disk. The effective radius distribution clearly shows a peak around 3.4 pc, which is consistent with the turnover in the size distributions of other young cluster populations. The location of the peak is also similar to the prefered radius of galactic and extra-galactic *globular* clusters. This suggests that the preferred radius of star clusters is determined during the formation or during the very early evolution of the clusters and that it is not susceptible to change.

The radial distribution of the clusters in M51 follows the distribution of their parental GMCs, namely an exponential decrease with a scalelength of $\sim$2 kpc. We see more clusters at the point of co-rotation, indicating that this is a preferred site of cluster formation.

In the near future we will focus on the evolution of the concentration parameters and ages and masses of the star clusters in M51. Combined with their radii we then have the tools to study the formation and evolution of a galaxy's entire cluster population.

Publication status: *A&A, in prep.*
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P37 – Simulating The SKA With MeqTrees

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Future radio telescopes such as LOFAR and SKA present us with a number of unprecedented challenges. To select a design that will be able to achieve the SKA requirements, we need extremely elaborate models of the instrument and the observed sky. This makes detailed SKA simulations a vital part of any design effort.

The Measurement Equation (ME) provides a succinct mathematical framework in which an instrument and the observed objects may be described. The MeqTree module provides a flexible software system for implementing MEs of arbitrary structure and complexity, and for solving for arbitrary subsets of their parameters. The poster will examine how the ME and MeqTrees can be applied to SKA simulations. We will focus on one test case, that of a SKA composed of CLAR (Canadian Large Adaptive Reflector) dishes, and show detailed simulations of instrumental effects and their impact on observations with such a SKA.

Publication status: *Nederlands Astronomy Conference 2006, submitted*
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P38 – Light Weighed: Weak Lensing Challenges with KIDS

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Gravitational lensing is one of the most direct ways to study the seen and unseen content in the universe; in particular, weak lensing has a wide range of practical application and is only intrinsically limited by a trade off between statistical noise and resolution. These limits are pushed down significantly with large wide-field imaging surveys such as the recently-approved KIDS, and an additional but equally important challenge is to control systematic errors and uncertainties in such a large collection of data.

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P39 – Fast aperiodic variability in the Black Hole Binary GRS 1915+105

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We present X-ray observations of the Black-Hole Binary GRS 1915+105 made with the RXTE (Rossi X-ray Timing Explorer). We concentrated on timing analysis of the strong variability of this source, focusing on its aperiodic variability on short (< 1 s) time scales. Since its discovery in 1992, GRS 1915+105 was considered a peculiar source. Our results suggest that its general behaviour is similar to that of other black-hole binaries, but its state-transitions are much faster and difficult to analyze. In its power density spectra, we found a feature which is seen in many transient systems, but until now was not detected in GRS 1915+105 due to its elusiveness. As this feature has been associated to the collimation and emission of superluminal relativistic jets visible in the radio band, its presence on the prototypical galactic jet source strengthens this connection.

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P40 – Mapping the SiO circumstellar maser emission in AGB stars

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We present high resolution observations of SiO masers in a sample of late-type stars. We have used the NRAO Very Long Baseline Array (VLBA) to map the 43 GHz and the 86 GHz ^{28}SiO and ^{29}SiO masers. We report the first VLBI maps at 86 GHz (v=2 J=2–1) in O-rich circumstellar envelopes as well as the first VLBA images of SiO masers in an S–type Mira variable, χ Cyg. We have focused on the study of the relative spatial distribution of the different observed lines. We have found that in some cases the observational results are not reproduced by the current theoretical pumping models, either radiative or collisional. We suggest that the line overlaps between ro-vibrational transitions of abundant molecular species can explain the discrepancies found between the observations and the theoretical predictions and that this mechanism strongly affects the excitation of SiO.

Publication status:

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P41 – The search for substructure in the outer halo

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The Milky Way galaxy's halo has probably been formed through a series of mergers of smaller galaxies. The Spaghetti Survey (Morrison et al. 2000, AJ 119, 2254) was undertaken to search for such structures. An imaging programme using the Isaac Newton Telescope (INT) at La Palma has, over the last two years, identified ~ 100 metal-poor red giants at distances of 10 - 100 kpc from the Sun. The subsequent spectroscopic follow-up has been used to derive the velocity and metallicity of these halo stars. Here we present a preliminary analysis of their spatial and velocity distribution, that is aimed at quantifying what fraction of the halo originated in disrupted satellites.

Publication status: -

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P42 – Early Universe chemistry with Gamma-ray Bursts

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Gamma-ray Bursts (GRBs) have been seen out to $z = 6.29$. They enable the discovery of a population of distant, faint, star-forming galaxies in which they lie, not picked up by flux-limited surveys. Hence GRBs are a unique tool to probe cosmic chemical evolution and star-formation history. Absorption features imprinted on the bright optical afterglows reveal the conditions in the host galaxies. Metallicities, Z, spanning 0.01–0.1 $Z_\odot$ have now been measured in the spectra of nine $z > 2$ afterglows. Here we present 2 interesting cases: GRB 060206 and GRB 050730.

Publication status: *Starling et al. 2005, A&A 442, L21 and Fynbo et al. 2006, A&A Letters in press*

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P43 – Long-term radio observations of Circinus X-1

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We present radio observations of the X-ray binary Cir X-1 made with the Australia Telescope Compact Array (ATCA) at 4.8 and 8.6 GHz. The data is spread over a 10 years period (1996-2006) with unequal intervals between epochs of several months. Additional information on the radio behavior of the Cir X-1 complex is provided by a few simultaneous ATCA 1.4 and 2.5 GHz observations.

Publication status: *in preparation*

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P44 – Algols contribute to the ISM

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We revisited the analytical expression for the mass ratio distribution for non-evolved binaries with a B type primary. Selection effects governing the observations were taken into account in order to compare theory with observations. Theory was optimized so as to fit best with the observed q-distribution of SB1s and SB2s. The accuracy of this theoretical mass ratio distribution function is severely hindered by the uncertainties on the observations. Our computations are compared statistically to the observed distributions of orbital periods and mass ratios of Algols. Conservative Roche Lobe Over Flow (RLOF) reproduces the observed distribution of orbital periods but fails to explain the observed mass ratios in the range $q \in [0.4\text{-}1]$. In order to obtain a better fit the binaries have to lose a significant amount of matter, without losing much angular momentum. We tested the following binary evolutionary scenario: The mass acquired by the gainer during RLOF enhances the rotational velocity of the latter. This acceleration is counteracted by tidal forces. Both mechanisms may speed up the equatorial velocity of the gainer close to its critical value. The luminosity of the gainer is amplified with the accretion luminosity in the equatorial region. It happens only during a short period of rapid RLOF that upspinning and luminosity act together so as to blow mass and angular momentum away from the gainer into the interstellar medium. As a consequence, also Algols contribute to the ISM. The binaries remain a longer time with a higher mass ratio as they would do evolving conservatively. Since the mass is blown away from the gainer as an enhanced stellar wind not much angular momentum is taken away from the system. With this scenario the observed distributions of mass ratios and orbital periods of Algols will be better reproduced by theory than conservative evolution would do.

Publication status: *Astron. Astrophys., 446, 1071-1080, 2006*

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P45 – The Interaction of Supernovae with their Circumstellar Medium

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During the lifetime of a massive star, the stellar wind has important effects on the evolution of its Circumstellar Medium (CSM). In stead of a constant density Interstellar Medium the stellar wind creates a large bubble of much lower density and one or more shells with higher density. At the end of the stellar life, the supernova ejecta evolution is affected by this CSM evolution. The interaction of the supernova ejecta with the changed CSM may give rise to interesting features. For example, the light curve of a supernova might rise after some time, similar to SN1987A. In my Master research I perform hydrodynamical simulations of the CSM starting on the Main Sequence and following the evolution to the supernova explosion and beyond. This allows me to predict the brightness evolution of a supernova. These simulations are done by using a magneto-hydrodynamical code called ZEUS3D. Here we present results of a model for supernova 2001em.

Publication status:

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P46 – The disk around HD142527

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Herbig Ae/Be stars are intermediate mass, pre-main sequence stars with an IR excess and emission lines. The observed IR excess is due to circumstellar dust confined to a disk. Based on the amount of excess emission the geometry of these disks is considered to be either flaring or highly flattened, classified by Meeus et al. (2001) as group I or II respectively. The evolution of the composition and structure of these disks is extensively studied as they are generally believed to be the sites of ongoing planet-formation. In this study we focus on the F6IIIe star HD142527.

We gathered quite a comprehensive data set on this object, consisting of an ISO spectrum from 3 to 200 μm, a Spitzer spectrum from 5 to 37 μm, Subaru coronagraphic images at 1 μm, MIDI interferometric spectroscopy from 8 to 13 μm, VISIR imaging at 11 and 19 μm, SEST and ATCA photometry at 1.3 and 3.5 mm. From the analysis of these data the picture emerges that HD142527 has an inner disk (1-20 AU) structure which is typical for Herbig Ae/Be stars, namely a puffed up inner rim with a shadowed, rather flat disk geometry further out (representative for group II). However, at some unknown distance from the star, probably between 50 and several 100 AU, a fairly massive reservoir of cold dust is present which is responsible for the emission longwards of 30 μm and probably also causes the scattering seen in the Subaru images. This cold dust seems very processed, since it contains both crystalline H_2O ice and FeS. The cold dust component is also responsible for the large IR excess found with ISO. The origin of this extra luminosity, which cannot be accounted for in regular passive disk models, is unknown. We will speculate on a possible explanation for the peculiar geometry of the disk of HD142527.

Publication status: *A&A article in preparation*

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P47 – Interferometric detection of alumina grains in Betelgeuse

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We present a study of the extended atmosphere of the late-type supergiant α Orionis. Infrared spectroscopy of red supergiants reveals strong molecular bands, some of which do not originate in the photosphere but in a cooler layer of molecular material above it. Lately, these layers have been spatially resolved by near and mid-IR interferometry. In this contribution, we try to reconcile the IR interferometric and ISO-SWS spectroscopic results on α Ori with a thorough modelling of the photosphere, molecular layer(s) and dust shell. From the ISO and near-IR interferometric observations, we find that α Ori has only a very low density water layer close above the photosphere. However, mid-IR interferometric observations and a narrow-slit N-band spectrum suggest much larger extra-photospheric opacity close to the photosphere at those wavelengths, even when taking into account the detached dust shell. We argue that this cannot be due to the water layer, and that another source of mid-IR opacity must be present. We show that this opacity source is probably neither molecular nor chromospheric. Rather, we present amorphous alumina (Al_2O_3) as the best candidate and discuss this hypothesis in the framework of dust-condensation scenarios.

Publication status: *2006, A&A, v447, p311*
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P48 – The production of ^{26}Al in massive close binaries

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The decay of the radioactive isotope ^{26}Al to ^{26}Mg is accompanied by emission of a gamma photon of approximately 1.8 MeV. With a lifetime of ^{26}Al of approximately $7.2{\cdot}10^5$ yr, much shorter than the timescale of Galactic evolution, observation of this gamma emission line demonstrates that nucleosynthesis is currently active in our Galaxy. COMPTEL observations show a diffuse emission along the Galactic plane and suggest the presence of 2-3 $M_\odot$ of ^{26}Al in our galaxy today. Although the observations point towards massive stars as main sources of galactic ^{26}Al, its origin is still under debate. In my master research I model the contribution of massive close binaries as possible sources. This model was first proposed by Langer (1998) and consists of two massive stars of comparable mass at a small initial orbital separation which go through Roche Lobe overflow (case A). As the secondary accretes mass, its convective core grows and fresh ^{25}Mg will be mixed into the core to form new ^{26}Al by proton captures. This ^{26}Al can be expelled rather quickly, because the secondary is near the end of its lifetime by the time of mass transfer. For somewhat higher initial periods (case B) a scenario with a second (unstable) mass transfer from the secondary to the primary causing a common envelope to develop is investigated. Partial ejection of the common envelope including ^{26}Al could provide part of the observed 1.8 MeV emission.

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P49 – Composite Oxygen-rich supernova remnant MSH11-54

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MSH11-54 is an oxygen-rich supernova remnant. Its composition, besides oxygen the remnant is also rich in Ne and Mg, suggests a progenitor mass above 20 $M_{\odot}$. Interestingly, the supernova remnant also contains an active pulsar, surrounded by a pulsar wind nebula. The remnant therefore shares characteristics with both shell type supernova remnants such as Cas A and pulsar wind dominated remnants such as the Crab nebula. Hence the classification composite supernova remnant. By analysing X-ray data from XMM-Newton constraints can be found on the energetics, progenitor mass and age of the supernova remnant. The presence of a pulsar is in particular interesting, because massive stars are thought to result in the formation of a black hole, rather than a neutron star, but the actual progenitor mass for which black hole formation occurs in not well known. Moreover, the presence of a pulsar wind may help to constrain the evolutionary state of the supernova remnant, by looking for a signature for interaction of the reverse shock with the pulsar wind nebula.

Publication status: *In preparation*

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P50 – Dark matter in NGC 2974: from 100 pc to 10 kpc scales

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We present H I observations of the elliptical galaxy NGC 2974, obtained with the `Very Large Array`. These observations reveal that the previously detected H I disk in this galaxy (Kim et al. 1988) is in fact a ring. Combining the flat rotation curve with the central kinematics of the ionized gas, obtained with the integral-field spectrograph `SAURON`, allows us to determine the mass to light ratio M/L as a function of radius, ranging from 100 pc in the centre to 10 kpc at the edges of the H I ring. A dark halo is required to explain the observed rotation: at the outer radii $\sim$70% of the total mass is dark.

Publication status: *in preparation*

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P51 – Star Formation in the G48 Infrared Dark Cloud: a Spitzer View

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Imaging of the Infrared Dark Cloud (IRDC) G48 (distance ~ 2.5 kpc) has been obtained in five bands in the frequency range 3 – 24 μm, using the IRAC and MIPS instruments on board the *Spitzer Space Telescope*. We extract stellar candidates from the images by fitting point source profiles. We use color-color and color-magnitude diagrams, based upon the four IRAC bands and the MIPS band, to identify and classify the Young Stellar Objects (YSO). Statistics will be used to determine whether these YSO are spatially associated to the IRDC. Previous JCMT observations (continuum and heterodyne) indicate active star formation in this cloud. Our analysis of the Spitzer observations will provide the first overview of the YSO content of G48 and it will result in a better understanding of its star forming nature.

Publication status: –

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P52 – Self-noise in full sky LOFAR images

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Kulkarni (AJ, vol. 98, no. 3, pp 1112-1130, sept. 1989) has provided a mathematically rigorous treatment of the noise in sky images derived from radio interferometers. His analysis indicates that the distribution of noise over the map follows the source distribution. This implies an increase of the noise at source locations and is therefore aptly called self-noise. In observations with current radio telescopes this effect is only visible for the brightest sources due to the dominance of the receiver temperature in most observations. Even on the brightest sources only a qualitative comparison with the model predictions has been demonstrated in 327 MHz VLA observations on Cas A and Cyg A (McCullough, AJ, vol. 106, no. 2, pp 797-803, aug. 1993). The situation for sky noise dominated systems such as LOFAR (Wijnholds, Bregman and Boonstra, Exp. Astron., vol. 17, no. 1, pp 35-42, 2004) is different. This will be demonstrated by comparing the experimentally determined variance in full sky images produced by LOFAR's initial test station with the variance distribution over the map predicted by the model described by Kulkarni. Good quantitative agreement is found between the model predictions and the experimental results.

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P53 – Universe Awareness, an inspirational programme for economically disadvantaged young children

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Universe Awareness is a new programme aimed at children between 4 and 10 years of age in economically disadvantaged environment and in developing countries.

Universe Awareness is motivated by the premise that access to simple knowledge about the Universe is a birth right. The ages of 4 to 10 years are crucial in the development of a value system. At that age, children can appreciate the beauty of astronomical objects and can develop a 'feeling' for the vastness of the Universe. Exposing young children to such material is likely to broaden their minds and stimulate their world-view.

A successful pilot project has taken place in Venezuela. From spontaneous observations of the sky in remote locations to teacher-training workshops in the "Centro de Investigaciones de Astronomia" in Mérida, this was a wonderful experience for participants and organisers alike. It provides a glimpse of how successful the Universe Awareness programme can be.

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