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Abstracts of recently accepted papers

The Henize sample of S stars. I. The technetium dichotomy

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This paper is the first one in a series investigating the properties of the S stars belonging to the Henize sample (205 S stars with $\delta < -25°$ and $R < 10.5$) in order to derive the respective properties (like galactic distribution and relative frequencies) of intrinsic (i.e. genuine asymptotic giant branch) S stars and extrinsic (i.e. post mass-transfer binary) S stars. High-resolution (R=30 000 to 60 000) spectra covering the range $\lambda\lambda 4230 - 4270$Å have been obtained for 76 S stars, 8 M stars and 2 symbiotic stars.

The λ4262Å and λ4238Å blends involving a Tc I line were analysed separately and yield consistent conclusions regarding the presence or absence of technetium. Only one 'transition' case (Hen 140 = HD 120179, a star where only weak lines of technetium are detectable) is found in our sample. A resolution greater than R = 30 000 is clearly required in order to derive unambiguous conclusions concerning the presence or absence of technetium. The Tc/no Tc dichotomy will be correlated with radial velocity and photometric data in a forthcoming paper.

Accepted by A&A

Preprints can be obtained by contacting svaneck@astro.ulb.ac.be *or via WWW on* http://astro.ulb.ac.be/

WWW database of optical constants for astronomy

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The database we announce contains references to the papers, data files and links to the Internet resources related to measurements and calculations of the optical constants of the materials of astronomical interest: different silicates, ices, oxides, sulfides, carbides, carbonaceous species from amorphous carbon to graphite and diamonds, etc.

We describe the general structure and content of the database which has now free access via Internet:
http://www.astro.uni-jena.de/Users/database/entry.html or *http://www.astro.spbu.ru/JPDOC/entry.html.*

Accepted by Astron. Astrophys. Suppl.

Preprints can be obtained by contacting vi2087@vi2087.spb.edu

Detection of collimated bipolar outflows in the planetary nebula NGC 6572 shaping its nebular shell

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Highly collimated, bipolar outflows have been detected in the planetary nebula NGC 6572 via ground-based optical imagery and high resolution long-slit spectroscopy. Kinematics and morphology together provide strong evidence of a direct interaction between the collimated outflows and the nebular elliptical shell, creating a double point-symmetric structure. As a consequence of this interaction, the elliptical shell has been broken up and, in this process, parts of the shell have been accelerated whereas the collimated outflow has been slowed down and/or deflected. These results strengthen the notion that collimated outflows are common in planetary nebulae and may play an important role in shaping the nebular shells. Additionally, our kinematic data give a solid confirmation to previous estimates used to derive the distance to this nebula with the parallax expansion method.

Accepted by ApJ Part 1

Preprints can be obtained by contacting lfm@iaa.es

Atomic fine-structure lines in the ISO-SWS spectra of the supergiants α Ori and α Sco

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We report the detection of infrared fine-structure lines of [Fe II] and [Si II] in the ISO-SWS spectra of two supergiants, α Ori and α Sco. From the observed intensities we infer that the emitting regions have temperatures in the range 1200-1800 K and are located within about 20 R_* from the star. This is interior to the region where dust is supposed to condense in the expanding envelope so that Fe and Si are not yet incorporated into the dust. The gas density required to thermalize these lines is of order 10^6 cm^{-3} consistent with the expected density in the outflow at the adopted location. The total mass of gas being cooled through these atomic fine structure lines is of the order of 10^{-4} $M_\odot$. Our calculation shows that cooling through the [O I] 63 μm line extends over a larger radius than for both [Fe II] and [Si II].

Accepted by A&A

Preprints can be obtained by contacting kay@astro.su.se
or via WWW on http://www.astro.su.se/publications
or via anonnymous ftp on ftp://erling.astro.su.se/pub/kay/supergiants.ps.gz

Luminous carbon stars in the Large Magellanic Cloud

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We present ground-based 3 μm spectra of obscured Asymptotic Giant Branch (AGB) stars in the Magellanic Clouds (MCs). We identify the carbon stars on the basis of the 3.1 μm absorption by HCN and C_2H_2 molecules.

We show evidence for the existence of carbon stars up to the highest AGB luminosities ($M_{\rm bol} = -7$ mag, for a distance modulus to the LMC of 18.7 mag). This proves that Hot Bottom Burning (HBB) cannot, in itself, prevent massive AGB stars from becoming carbon star before leaving the AGB. It also sets an upper limit to the distance modulus of the Large Magellanic Cloud of 18.8 mag.

The equivalent width of the absorption band decreases with redder $(K - L)$ colour when the dust continuum emission becomes stronger than the photospheric emission. Carbon stars with similar $(K - L)$ appear to have equally strong 3 μm absorption in the MCs and the Milky Way. We discuss the implications for the carbon and nitrogen enrichment of the stellar photosphere of carbon stars.

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For preprints, contact jvanloon@astro.uva.nl

M4–18: The planetary nebula and its WC10 central star

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We present a detailed analysis of the planetary nebula M4–18 (G146.7+07.6) and its WC10-type Wolf-Rayet central star, based on high quality optical spectroscopy (WHT/UES, INT/IDS, WIYN/DensPak) and imaging (HST/WFPC2). From a non-LTE model atmosphere analysis of the stellar spectrum, we derive $T_{\rm eff}$=31 kK, $\log(\dot{M}/M_\odot\,{\rm yr}^{-1})$=–6.05, v_∞=160 km s^{-1} and abundance number ratios of H/He<0.5, C/He=0.60 and O/He=0.10. These parameters are remarkably similar to He 2–113 ([WC10]). Assuming an identical stellar mass to that determined by De Marco et al. for He 2–113, we obtain a distance of 6.8 kpc to M4–18 ($E_{\rm B-V}$=0.55 mag from nebular and stellar techniques). This implies that the planetary nebula of M4–18 has a dynamical age of $\sim$3 100 years, in contrast to $\geq$270 years for He 2–113. This is supported by the much higher electron density of the latter. These observations may only be reconciled with evolutionary predictions if [WC]-type stars exhibit a range in stellar masses.

Photo-ionization modelling of M4–18 is carried out using our stellar WR flux distribution, together with black-body and Kurucz energy distributions obtained from Zanstra analyses. We conclude that the ionizing energy distribution from the Wolf-Rayet model provides the best consistency with the observed nebular properties, although discrepancies remain.

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or via WWW on http://www.astro.phys.ethz.ch/staff/demarco/private/Publications.html *or via anonnymous ftp on* ftp://saturn.ethz.ch/pub/orsola/PreOffPrints/M418.ps.gz

High-Resolution *ISO* Spectroscopy of the Unidentified 21 μm Feature

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We present *ISO* SWS06 observations of the 21 μm feature in eight sources, including a first detection of the feature in IRAS Z02229+6208. The observed feature peak-to-continuum ratios range from 0.13 in IRAS Z02229+6208 to 1.30 in IRAS 07134+1005. The normalized spectra, obtained by removal of the underlying continua and scaling the features to the same peak flux value, show that all features have the same intrinsic profile and peak wavelength. There is no evidence for any discrete sub-structure due to molecular bands in the observed spectra, suggesting that the 21 μm feature is either due to a solid substance or a mixture of many similarly structured large molecules.

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Preprints can be obtained by contacting kwok@iras.ucalgary.ca

Infrared properties of SiC particles

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We present basic laboratory infrared data on a large number of SiC particulate samples, which should be of great value for the interpretation of the 11.3 μm feature observed in the spectra of carbon-rich stars. The laboratory spectra show a wide variety of the SiC phonon features in the 10-13 μm wavelength range, both in peak wavelength and band shape. The main parameters determining the band profile are morphological factors as grain size and shape and, in many cases, impurities in the material. We discovered the interesting fact that free charge carriers, generated e.g. by nitrogen doping, are a very common characteristics of many SiC particle samples. These free charge carriers produce very strong plasmon absorption in the near and middle infrared, which may also heavily influence the 10-13 μm feature profile via plasmon-phonon coupling.

We also found that there is no systematic dependence of the band profile on the crystal type (α- vs. β-SiC). This is proven both experimentally and by theoretical calculations based on a study of the SiC phonon frequencies. Further, we give optical constants of amorphous SiC. We discuss the implications of the new laboratory results for the interpretation of the spectra of carbon stars.

Accepted by Astronomy and Astrophysics

Preprints can be obtained by contacting mutschke@astro.uni-jena.de WWW

An Atlas of Images of Planetary Nebulae

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A catalogue of narrowband CCD images of 100 southern and 1 northern Planetary Nebulae is presented. The data are images taken in the light of the Hα, Hβ, [OIII]500.7nm, and [NII]658.4nm lines. For each image we give

the exposure time, the maximum extent of the nebula, and the seeing measured from the frames themselves. For ease of reference, we have added an alphabetical list of the objects. Our list will be useful for morphological studies of Planetary Nebulae, and is complementary to previously published lists, especially the one of Schwarz et al. (1992).

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Preprints can be obtained via WWW on http://www.ncac.torun.pl/škg/art/gscw99.html
or via anonnymous ftp on ftp://ftp.ncac.torun.pl/pub/hide/SKG

IRAS04496−6958: A luminous carbon star with silicate dust in the Large Magellanic Cloud

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We describe ISO observations of the obscured Asymptotic Giant Branch (AGB) star IRAS04496−6958 in the Large Magellanic Cloud (LMC). This star has been classified as a carbon star. Our new ISOCAM CVF spectra show that it is the first carbon star with silicate dust known outside of the Milky Way. The existence of this object, and the fact that it is one of the highest luminosity AGB stars in the LMC, provide important information for theoretical models of AGB evolution and understanding the origin of silicate carbon stars.

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How to search for AGB stars in near-IR post-starburst spectra

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Based on evolutionary spectral synthesis models explicitly including the spectra of variable AGB stars, we select near-IR features that dentify the strong O-rich or C-rich AGB contributions to the near-IR light of post-starburst populations. AGB temperature scales and lifetimes remain major sources of uncertainties. We discuss applications and suggest massive post-starburst clusters as prime targets for observational tests.

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Preprints can be obtained by contacting lancon@astro.u-strasbg.fr
or via WWW on http://astro.u-strasbg.fr/∼lancon/popul.html

Interferometric observations of R Leonis in the K band

First direct detection of the photospheric pulsation and study of the atmospheric intensity distribution

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The Mira-type star R Leonis was observed at two different epochs in the K band with the FLUOR beam combiner on the IOTA interferometer. A variation of diameter is clearly detected for the very first time at this wavelength revealing an apparent pulsation of atmospheric layers very close to the stellar photosphere. We discuss the excess of visibility measured at high spatial frequencies and show that they very likely reveal smaller diameters of the photosphere (22-24 mas) than those deduced on the basis of shorter frequency components. This smaller diameter makes R Leonis a fundamental pulsator. Mira models are compared to our data and a disagreement with spatial intensity distribution and dynamical behaviour is found.

Accepted by A&A

Preprints can be obtained by contacting perrin@hplyot.obspm.fr
or via WWW on http://despa.obspm.fr/fluor/publications.html

Orbiting molecular reservoir around evolved red giant stars

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We report molecular emission from the circumstellar envelopes of two carbon rich stars with oxygen-rich envelopes, EU And and BM Gem. We find a narrow (FWHM $\sim$ 5 km s^{-1}) CO (2-1) emission line from EU And, and an even narrower (FWHM $\sim$ 1 km s^{-1}) ^{13}CO emission line from BM Gem. We also place upper limits to the emission of HCN, SiO, SO, HCO$^+$ and CS from BM Gem. We argue that the narrow CO emission lines are signatures of long-lived reservoirs of orbiting gas, and that standard models for CO emission from red giant winds are not appropriate for these two stars.

By including the Red Rectangle and AC Her, narrow CO emission characteristic of gravitationally bound gas has been detected from four post-main sequence systems, and we can begin to characterize these apparently similar environments. Some common characteristics are: (1) Their diameters are typically between $\sim$ 100 AU and $\sim$1000 AU. (2) The masses of CO are near 10^{27} g. (3) Unlike the envelopes around mass-losing carbon stars where $M_{CO}/M_{dust} \sim 2$, the circumstellar orbiting reservoirs often appear to have $M_{CO} < M_{dust}$. (4) Molecules in addition to CO seem to be rare; we have yet to detect any other abundant gas phase molecule besides CO. (5) Grains from 20 μm to 0.2 cm in radius may be common in these systems. (6) The reservoirs can possess large clumps. These properties can be understood if substantial chemical and dynamical evolution has occurred during the long lifetime of the orbiting reservoirs which are probably produced during mass-loss in a binary system.

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Preprints can be obtained by contacting jura@clotho.astro.ucla.edu