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Abstract of recently accepted papers

Dust in Brown Dwarfs I. Dust formation under turbulent conditions on microscopic scales

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Dust formation in turbulent media is studied adopting the example of brown dwarf atmospheres. By combining asymptotic techniques and time-dependent, multi-dimensional numerical simulations, we show that acoustic waves originating from convective motions provide a mechanism to initiate dust nucleation in otherwise dust-hostile environments. The subsequently growing particles cause a radiative cooling strong enough to re-initiate efficient dust formation resulting in a strongly inhomogeneous distribution of dust in such environments. Recent observations bear indications for such cloudy dust distributions in brown dwarf atmospheres.

Preprints can be obtained by contacting chris@astro.physik.tu-berlin.de
or on http://astro.physik.TU-Berlin.DE/~chris/arbeiten.html

IUE and ISO observations of the bipolar proto-planetary nebula Hen 401 (IRAS 10178-5958)

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We present ultraviolet (IUE) and infrared (ISO) observations of the bipolar proto-planetary nebula Hen 401 which, combined with previously available optical and near infrared data, are used to reconstruct the overall spectral energy distribution from 1150 Å to 100 μm.

The ISO spectrum is dominated by strong PAH emission overimposed on a very cold continuum which is interpreted as thermal emission originated in the C-rich cool dust (∼106 K) present in the circumstellar envelope, the remnant of the previous AGB phase. In addition, a second, hotter component detected in the near infrared is attributed to thermal emission from hot dust (∼ 640 K), suggesting that mass loss and dust grain formation is still on-going during the current post-AGB phase.

The ultraviolet (IUE) spectrum shows a stellar continuum in the wavelength interval 2400 Å to 3200 Å which corresponds to a moderately reddened B8-type central star. Unexpectedly, the UV flux in the wavelength interval 1150 Å to 1900 Å is very weak or absent with no evidence of a hotter binary companion which could explain the detection of the nebular emission lines observed in the available ground-based optical spectra of Hen 401. HST WFPC2 high resolution images show also no indication of a hot companion to the B8-type central star observed both in the optical and in the UV. The evolutionary implications of a possible single nature for the central star of Hen 401 are discussed.

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Preprints can be obtained by contacting parths_m@cc.nao.ac.jp *or* pgarcia@iso.vilspa.esa.es

UV (IUE) spectra of the central stars of high latitude planetary nebulae Hb7 and Sp3

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We present an analysis of the UV (IUE) spectra of the central stars of Hb7 and Sp3. Comparison with the IUE spectrum of the standard star HD 93205 leads to a spectral classification of O3V for these stars, with an effective temperature of 50,000 K. From the P-Cygni profiles of CIV (1550Å), we derive stellar wind velocities and mass loss rates of -1317 kms$^{-1}\pm$ 300 kms^{-1} and 2.9X10^{-8}M$_\odot$ yr^{-1} and -1603 kms$^{-1}\pm$400 kms^{-1} and 7X10^{-9}M$_\odot$ yr^{-1} for Hb7 and Sp3 respectively. From all the available data, we reconstruct the spectral energy distribution of Hb7 and Sp3.

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Preprints can be obtained by contacting gauba@iiap.ernet.in

or on http://arXiv.org/abs/astro-ph/0105287

Evidence for a binary system at the core of the bipolar protoplanetary nebula OH 231.8+4.2

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We present Very Large Array (VLA) observations of H_2O and OH (1612 MHz) maser emission made toward the protoplanetary nebula OH 231.8+4.2. The H_2O observations show two features at v_{LSR} of 23.1 and 44.5 km s$-$1, located at $\alpha(1950)= 07^h39^m58\overset{s}{.}98 \pm 0\overset{s}{.}01$; $\delta(1950)= -14°35'42\overset{''}{.}0 \pm 0\overset{''}{.}1$, coinciding in position within error with the SiO (v=1; J=2-1) maser position from Sánchez Contreras et al. The H_2O and SiO masers are most likely tracing the position of QX Pup, the Mira near the center of OH 231.8+4.2. This position is, however, clearly offset by $\sim 1''$ from the axis of the bipolar outflow traced by the OH maser emission. The OH (1612

MHz) maser emission spectrum shows three main components at v_{LSR} of 5.8, 20.0 and 27.4 km s−1, distributed over a region of 2″ whose position and kinematics appear to trace the bipolar outflow of this source. These results suggest the presence of a binary system: one invisible star powering the bipolar outflow and the other, the Mira star QX Pup, associated with the H_2O and SiO masers. However, this scenario requires that the two stars have evolved at very similar rates (implying very similar masses).

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Detection and Significance of Zn^{+3} 3.625 μmin Planetary Nebulae

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We have identified a line at 3.625 μm in the planetary nebulae (PNs) NGC 7027 and IC 5117 as the $^2D_{3/2}$–$^2D_{5/2}$ fine-structure transition of the $3d^9$ ion Zn^{+3}. Zinc (N = 30) is believed to be made primarily by explosive nucleosynthesis and *r*-process neutron capture reactions, and because Zn/H closely tracks Fe/H in metal-poor stars and is relatively undepleted into dust in the ISM, Zn/H has been used as a surrogate for Fe/H in the high-redshift universe. However, some isotopes of Zn are also produced as part of the *s*-process in AGB stars, the progenitors of PNs. Although there is currently no published calculation of the collision strength for Zn^{+3} 3.625 μm, for plausible values the observed line fluxes do not require Zn/H greater than solar, suggesting that these two PNs, which have elevated abundances of other *s*-process elements and C, are not significantly self-enriched in Zn. Consequently, Zn/H determined from emission lines should be a good indicator of elemental Fe/H in PNs, where gas-phase Fe/H values cannot be used directly due to depletion effects, enabling comparisons between nebular and stellar Fe/H abundances. We also report an upper limit on the strength of the 1-0 $P(2)$ line of HeH^+ at 3.608 μm in NGC 7027.

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Preprints can be obtained by contacting harriet@astro.as.utexas.edu

OH maser mapping of the evolved star HD 179821: evidence for interacting outflows

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The evolved star HD 179821 continues to be the subject of much debate as to whether it is a nearby (D = 1 kpc) post-AGB star or a distant (D = 6 kpc) high initial mass ($M_i \geq 30M_\odot$) post-red supergiant. We have mapped the OH maser emission around HD 179821 in the 1612 MHz and 1667 MHz lines with the MERLIN interferometer array at a resolution of 0.4 arcsec and 0.35 km s^{-1}. The OH emission lies in a thick shell with inner and outer radii of 1.3 and 2.9×10^{15} m (D = 6 kpc) and expansion velocity 30 km s^{-1}. Although we find some evidence for acceleration and for deviations from spherical symmetry, the bulk of the maser emission is consistent with a constant velocity spherical shell. The extent of the shell agrees with H_2O and OH dissociation models and supports a distance estimate of 6 kpc. However, the shell is incomplete and appears to have been disrupted by more recent collimated outflow activity within the last 1500 years. We suggest that this activity

is also responsible for the active envelope chemistry (in particular the presence of HCO^+) and for the apparent offset of the star from the centre of the shell. The luminous yellow hypergiant star IRC +10420 also shows signs of recent outflows and HD 179821 may be at a similar, perhaps slightly earlier, phase of evolution. We suggest that the SiO thermal emission arises from the same detached envelope as the OH maser emission, as in IRC +10420. If so then this would strengthen the connection between these two stars and probably rule out a post-AGB status for HD 179821.

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Preprints can be obtained by contacting T.Gledhill@star.herts.ac.uk
or via WWW on http://star.herts.ac.uk/preprints-2001.html

Scattered light models of the dust shell around HD 179821

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The dust shell around the evolved star HD 179821 has been detected in scattered light in near-IR imaging polarimetry observations. Here, we subtract the contribution of the unpolarized stellar light to obtain an intrinsic linear polarization of between 30 and 40 per cent in the shell which seems to increase with radial offset from the star. The J and K band data are modelled using a scattering code to determine the shell parameters and dust properties. We find that the observations are well described by a spherically symmetric distribution of dust with an r^{-2} density law, indicating that when mass-loss was occurring, the mass-loss rate was constant. The models predict that the detached nature of a spherically symmetric, optically thin dust shell, with a distinct inner boundary, will only be apparent in polarized flux. This is in accordance with the observations of this and other optically thin circumstellar shells, such as IRAS 17436+5003. By fitting the shell brightness we derive an optical depth to the star which is consistent with V band observations and which, assuming a distance of 6 kpc, gives an inner shell radius of $r_{\rm in} = 1.44 \times 10^{15}$ m, a dust number density of $N_{\rm in} = 2.70 \times 10^{-1}$ m^{-3} at $r_{\rm in}$ and a dust mass of $M_d = 0.08$ M$_\odot$. We have explored axisymmetric shell models but conclude that any deviations from spherical symmetry in the shell must be slight, with an equator-to-pole density contrast of less than 2:1. We have not been able to simultaneously fit the high linear polarizations and the small ($E(J-K) = -0.3$) colour excess of the shell and we attribute this to the unusual scattering properties of the dust. We suggest that the dust grains around HD 179821 are either highly elongated or consist of aggregates of smaller particles.

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Testing Nucleosynthesis Theory Of Sulfur, Chlorine, and Argon Using Planetary Nebulae. IIA: Observations of a Southern Sample

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In this paper we present fully reduced and dereddened emission line strengths for a sample of 45 southern Type II planetary nebulae (PNe). The spectrophotometry for these PNe covers an extended optical/near-IR

range from 3600 - 9600 Å. This PN study and subsequent analysis (presented in a companion paper), together with a similar treatment for a northern PN sample, is aimed at addressing the lack of homogeneous, consistently observed, reduced, and analyzed data sets that include the near-IR [S III] lines at 9069 and 9532 Å. The use of Type II objects only is intended to select disk nebulae that are uncontaminated by nucleosynthetic products of the progenitor star. Extending spectra redward to include the strong [S III] lines enables us to look for consistency between S^{+2} abundances inferred from these lines and from the more accessible, albeit weaker, [S III] line at λ6312.

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Non-linear radiative models of post-AGB stars: application to HD 56126

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In order to study in a general manner the pulsations of the post-AGB stars we performed a grid of non-linear radiative low-mass, high-luminosity models in a wide range of Teff, L and M. Theoretical bolometric light curves and radial velocity curves have been computed as well as their associated power spectra. We have also examined the behaviour of these models along the stellar mass, the chemical composition and the opacity tables we have used in the code. Concerning the carbon rich post-AGB star HD 56126, the best models found to fit its observational characteristics are $X = 0.7$, $Z = 0.004$, $M = 0.8\,M_\odot$, $L = 6000$–$7000\,L_\odot$ and Teff ≤ 5850 K. Models computed with smaller mass fail to reproduce both the period and the pulsational amplitude of HD 56126, which is quite different from the pulsational amplitude of the RV Tauri stars. The previously analysed spectroscopic and photometric variations of HD 56126 appear to be consistent with a non-regular radial pulsation where the dominant pulsation mode is the first overtone. In the course of the pulsation, moderate shock waves are repeatedly generated and they propagate throughout the stellar atmosphere. They provoke a complex, asynchronous motion of the outer layers.

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The Constant-Velocity Highly Collimated Outflows of He 2-90

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We present high-dispersion echelle spectroscopic observations and a narrow-band [N II] image of the remarkable jet-like features of He 2-90. They are detected in the echelle spectra in the Hα and [N II] lines but not in other

nebular lines. The [N II]/Hα ratio is uniformly high, $\simeq$ 1. The observed kinematics reveals bipolar collimated outflows in the jet-like features and shows that the southeast (northwest) component expands towards (away from) the observer at a remarkably constant line-of-sight velocity, 26.0$\pm$0.5 km s^{-1}. The observed expansion velocity and the opening angle of the jet-like features are used to estimate an inclination angle of $\simeq 5^{\odot}$ with respect to the sky plane and a space expansion velocity of $\simeq$ 290 km s^{-1}. The spectrum of the bright central nebula reveals a profusion of Fe lines and extended wings of the Hα line, similar to those seen in symbiotic stars and some young planetary nebulae that are presumed to host a mass-exchanging binary system. If this is the case for He 2-90, the constant velocity and direction of the jets require a very stable dynamic system against precession and warping.

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The electron temperature of the inner halo of the Planetary Nebula NGC 6543

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We investigate the electron temperature of the inner halo and nebular core regions of NGC 6543, using archival Hubble Space Telescope (HST) Wide Field Planetary Camera 2 (WFPC2) images taken through narrow band [O III] filters. Balick et al. (2001) showed that the inner halo consists of a number of spherical shells. We find the temperature of this inner halo to be much higher ($\sim$15 000 K) than that of the bright core nebula ($\sim$8500 K). Photo-ionization models indicate that hardening of the UV radiation from the central star cannot be the main source of the higher temperature in the halo region. Using a radiation hydrodynamic simulation, we show that mass loss and velocity variations in the AGB wind can explain the observed shells, as well as the higher electron temperature.

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Mass, linear momentum and kinetic energy of bipolar flows in protoplanetary nebulae

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We have studied the CO emission from protoplanetary nebulae (PPNe). Our sample is composed of 37 objects and includes, we think, all well identified PPNe detected in CO, together with the two yellow hypergiants emitting in CO and one young PN. We present a summary of the existing CO data, including accurate new

observations of the ^{12}CO and ^{13}CO J=1–0 and J=2–1 lines in 16 objects. We identify in the nebulae a slowly expanding shell (represented in the spectra by a central core) and a fast outflow (corresponding to the line wings), that in the well studied PPNe is known to be bipolar. Excluding poor data, we end up with a sample of 32 sources (including the 16 observed by us); fast flows are detected in 28 of these nebulae, being absent in only 4. We present a method to estimate from these data the mass, 'scalar' momentum and kinetic energy of the different components of the molecular outflows. We argue that the uncertainties of our method can hardly lead to significant overestimates of these parameters, although underestimates may be present in not well studied objects. The total nebular mass is often as high as $\sim$1 $M_\odot$, and the mass-loss rate, that (presumably during the last stages of the AGB phase) originated the nebula, had typical values $\sim 10^{-4}$ $M_\odot$ yr^{-1}. The momentum corresponding to this mass ejection process in most studied nebulae is accurately coincident with the maximum momentum that radiation pressure, acting through absorption by dust grains, is able to supply (under expected conditions). We estimate that this high-efficiency process lasts about 1000 – 10000 yr, after which the star has ejected a good fraction of its mass and the AGB phase ends. On the other hand, the fast molecular outflows, that have probably been accelerated by shock interaction with axial post-AGB jets, carry a significant fraction of the nebular mass, with a very high momentum (in most cases between 10^{37} and 10^{40} g cm s^{-1}) and very high kinetic energy (usually between 10^{44} and 10^{47} erg). In general, yellow hypergiants and post-AGB objects with low initial mass show nebular masses and momenta that are, respectively, higher and lower than these values. We compare the momenta of the fast outflows with those that can be supplied by radiation pressure, taking into account the expected short acceleration times and some effects that can increase the momentum transfer. We find that in about 80% of PPNe, the fast molecular flows have too high momenta to be powered by radiation pressure. In some cases the momentum of the outflow is $\sim$1000 larger than that carried by radiation pressure; such high factors are difficult to explain even under exceptional conditions. Wind interaction is the basic phenomenon in the PN shaping from the former AGB envelopes; we conclude that this interaction systematically takes place along a dominant direction and that this process is not powered by radiation pressure. Due to the lack of theoretical studies, the possible momentum source remains a matter of speculation.

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H_2O in Stellar Atmospheres

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We have performed a detailed *ab initio* computation of the dipole moment surface, the vibrational transition moments, and the spectral lines for the water molecule. A total of 412 vibrational eigenstates were identified below 30 000 cm^{-1}, corresponding to $\approx$85,000 vibrational transitions. In principle there are many billions of allowed vibration-rotation transitions between these eigenstates. In our most complete test calculations we constructed a list of 3 billion (3×10^9) lines.

At room temperature, the computed monochromatic absorption coefficient is in good overall agreement with the HITRAN data base, while at higher temperatures its value exceeds the HITRAN-based absorption coefficient by more than an order of magnitude, due to the lack of high excitation lines in HITRAN. The agreement with the HITEMP version of HITRAN is considerably better than with the standard HITRAN.

By comparing stellar model atmospheric structures and synthetic spectra based on our most extensive line list with results from calculations excluding the huge number of ultra-weak lines, we conclude that when the lines are well chosen, a few times 10 million lines are more than sufficient for all astrophysical purposes. We therefore offer to the community a line list of 100 million lines, easily accessible by anonymous ftp.

Finally, we have compared results of synthetic stellar spectra based on this line list with observed ISO spectra and have found good agreement. In particular in the 2−4μm region around the strong fundamental bands, the agreement with observations is considerably better than that obtained with other available water line lists.

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SwSt 1: an O-rich planetary nebula around a C-rich central star

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The hydrogen-deficient [WCL] type central star HD167362 and its planetary nebula (PN) SwSt 1 are investigated. The central star has a carbon-rich emission line spectrum and yet the nebula exhibits a 10-μm emission feature from warm silicate dust, perhaps indicating a recent origin for the carbon-rich stellar spectrum. Its stellar and nebular properties might therefore provide further understanding as to the origin of the [WCL] central star class.

The central star optical and UV spectra are modelled with state of the art non-LTE codes for expanding atmospheres, from which the stellar parameters are determined. Using the Sobolev approximation code ISA-Wind, we find $T_{\rm eff}$=40 000 K, $\log(\dot{M}/{\rm M}_\odot\ {\rm yr}^{-1})$=–6.72, L=8900 $L_\odot$ (for a distance of 2.0 kpc), and $v_\infty \simeq$ 900 km s^{-1}. The abundance mass fractions for helium, carbon and oxygen is determined to be 37%, 51% and 12%, respectively. ¿From this we derive C/O=4.3 (by mass), confirming that the star suffered efficient third dredge-up. The nitrogen abundance is close to zero, while an upper limit of <10% by mass is established for H. The model uses a composite beta velocity law which allows us to reproduce the optical line profiles. The overall shape of the de-reddened spectrum agrees with the V-scaled (m_V=11.48 mag, E(B–V)=0.46 mag) model atmosphere, showing the nebular-derived reddening to be consistent with the reddening indicated by the stellar analysis. We confirm our model results by using the co-moving frame code CMFGEN, although a few differences remain.

The PN has a high electron density ($\log({\rm N}_e/{\rm cm}^{-3})$=4.5) and a small ionized radius (0.65 arcsec - measured from the HST-WF/PC Hβ images), indicating a young object. Its nebular abundances are not peculiar. The nebular C/O ratio is close to solar, confirming the PN as an O-rich nebula. The nebular N/O ratio of 0.08 is *not* indicative of a Type-I PN although the high stellar luminosity points to a relatively stellar mass. Near-IR spectroscopy is presented and fitted together with IRAS fluxes by using two blackbody curves with temperatures 1200 K and 230 K, indicating the presence of hot dust. We also report the first detection of H_2 in this young and compact PN.

All of the published spectroscopy since the discovery of SwSt 1 in 1895 has been re-examined and it is concluded that no clear spectral variability is seen, in contrast to claims in some previously-published studies. If an event occurred that has turned it into a hydrogen-deficient central star, it did not happen in the last 100 years.

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or via anonymous ftp on ftp://ftp.star.ucl.ac.uk/pub/od/PreOffprints/SwSt1_paper.ps.gz

A disrupted molecular ring in planetary nebula G119.3+00.3 (BV5-1)

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New, high-sensitivity interferometric CO observations of BV 5-1 show that the molecular gas in this bipolar planetary nebula is distributed along a very inhomogeneous ring made of clumps. The individual masses of such molecular clumps are $\sim 10^{-4}$ $M_{\odot}$. The BV 5-1 molecular ring is seen edge-on, it is nearly perpendicular to the axis of bipolarity of the nebula, and it is expanding with an expansion velocity of $\sim$9 km s^{-1}. BV 5-1 is confirmed to be a relatively evolved nebula, as indicated by both its kinematic age ($\sim$ 2.4 10^4 yr) and its molecular to ionized mass ratio ($\sim$ 0.3). The structure of the BV 5-1 molecular ring, as well as that of other rings previously observed in a few additional nebulae, underscore the importance of strongly asymmetrical mass loss processes starting early at the asymptotic giant branch phase.

Accepted by Astron. & Astrophys.

Preprints can be obtained by contacting josselin@graal.univ-montp2.fr

Discovery of three lead-rich stars

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About half of the stable nuclei heavier than iron are believed to be synthesized during the late stages of evolution of stars with masses in the range 0.8-8 solar masses. These elements are then expelled into the interstellar medium through stellar winds after being 'dredged up' towards the surface of the stars. These processes occur when the star is in the 'asymptotic giant branch' (AGB) phase of its life. Nuclei (mainly iron) deep inside the star slowly capture neutrons and progressively build up heavier elements (the 's-process'). For AGB stars that formed early in the history of the Galaxy, and that therefore have very low abundances of elements heavier than helium ('metals'), models predict that the s-process will accumulate synthesized material with atomic weights in the Pb-Bi region. Such stars will therefore have large overabundances of lead relative to other heavy elements. Here we report the discovery of large amounts of lead in three metal-poor stars (HD187861, HD196944 and HD224959). Our analysis shows that these stars are more enriched in lead than in any other element heavier than iron. The excellent agreement between the observed and predicted abundances reinforces our current understanding of the detailed operation of the s-process deep in the interiors of AGB stars.

Accepted by Nature

Preprints can be obtained by contacting svaneck@astro.ulb.ac.be

Circular Polarization of Circumstellar Water Masers around S Per

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We present the first circular polarization measurements of circumstellar H_2O masers. Previously the magnetic field in circumstellar envelopes has been estimated using polarization observations of SiO and OH masers. SiO masers are probes of the high temperature and density regime close to the central star. OH masers are found at much lower densities and temperatures, generally much further out in the circumstellar envelope. The detection of the circular polarization of the (6_{16}–5_{23}) rotational transition of the H_2O maser could be attributed to Zeeman splitting due to the magnetic field in the intermediate temperature and density regime. The fields inferred here agree well with predicted values for a combination of the r^{-2} dependence of a solar-type magnetic field, and the coupling of the field to the high density masing regions. We also discuss the unexpected narrowing of the circular polarization spectrum.

Accepted by Astronomy & Astrophysics

Preprints can be obtained by contacting vlemming@strw.leidenuniv.nl
or via WWW on http://arXiv.org/abs/astro-ph/0107070

Zirconium to Titanium Ratios in a Large Sample of Galactic S Stars

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The [Zr/Ti] ratio for a large sample of galactic S stars has been determined using high quality, high-resolution spectra. The pattern of Zr enhancements in intrinsic and extrinsic S stars is found to differ and the [Zr/Ti] ratio in the extrinsic S stars clearly links them to the strong barium stars. In addition, the pattern of [Zr/Ti] ratios seems to indicate that the progression of spectral type M-MS-S-SC is due largely to an increase in the abundance of s-process elements and not solely to a changing C/O ratio as claimed by some investigators Scalo and Ross (1976).

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Preprints can be obtained by contacting avanture@evcc.ctc.edu

The large-scale ionized outflow of CH Cygni

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HST and ground-based [OII] and [NII] images obtained in the period 1996–1999 reveal a complex, ionized optical nebula around the symbiotic binary CH Cyg extending out to 18″ or 5000 A.U. from the central stars.

The observed velocity range of the nebula, derived from long-slit echelle spectra, is 130 kms^{-1}. In spite of its complex appearance, the velocity data show that the basic morphology of the inner regions of the optical nebula is that of a bipolar outflow extending nearly along the plane of the sky out to some 2000 A.U. from the center.

Even if the extension of this bipolar outflow and its position angle are consistent with those of the radio jet produced in 1984 (extrapolated to the time of our optical imagery), no obvious optical counterpart is visible of the original, dense radio bullets ejected by the system. We speculate that the optical bipolar outflow might be the remnant of the interaction of the bullets with a relatively dense circumstellar medium.

Accepted by ApJ

Preprints can be obtained by contacting rcorradi@ing.iac.es, *or via WWW on* ftp://ftp.ll.iac.es/pub/research/preprints/PP252001

Evidence for binarity in the bipolar planetary nebulae A 79, He 2-428 and M 1-91

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We present low and high resolution long-slit spectra of three bipolar planetary nebulae (PNe) with bright central cores: A 79, He 2-428 and M 1-91. He 2-428 and M 1-91 have high density (from $10^{3.3}$ to $10^{6.5}$ cm^{-3}) unresolved nebular cores that indicate that strong mass loss/exchange phenomena are occurring close to their central stars. An F0 star is found at the centre of symmetry of A 79; its reddening and distance are consistent with the association of the star with the nebula. The spectrum of the core of He 2-428 shows indications of the presence of a hot star with red excess emission, probably arising in a late-type companion. A 79 is one of the richest PNe in N and He, the abundances of M 1-91 are at the lower end of the range spanned by bipolar PNe, and He 2-428 shows very low abundances, similar to those measured for halo PNe. The extended nebulae of A 79 and He 2-428 have inclined equatorial rings expanding at a velocity of $\sim$15 km s^{-1}, with kinematical ages $\geq 10^4$ yrs. The association of these aged, extended nebulae with a dense nebular core (He 2-428) or a relatively late type star (A 79) is interpreted as evidence for the binarity of their nuclei.

Accepted by Astronomy & Astrophysics

Preprints can be obtained by contacting mrodri@inaoep.mx

Laboratory Astrophysics and Collimated Stellar Flows: The Production of Radiatively Cooled Hypersonic Plasma Jets

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We present first results of astrophysically relevant experiments where highly supersonic plasma jets are generated via conically convergent flows. The convergent flows are created by electrodynamic acceleration of plasma in a conical array of fine metallic wires (a modification of the wire array Z-pinch). Stagnation of plasma flow on the axis of symmetry forms a standing conical shock effectively collimating the flow in the axial direction. This scenario is essentially similar to that discussed by Cantó and collaborators as a purely hydrodynamic mechanism for jet formation in astrophysical systems. Experiments using different materials (Al, Fe and W) show that a highly supersonic ($M \sim 20$), well-collimated jet is generated when the radiative cooling rate of the plasma is significant. We discuss scaling issues for the experiments and their potential use for numerical code verification. The experiments also may allow direct exploration of astrophysically relevant issues such as collimation, stability and jet-cloud interactions.

Accepted by ApJL

Preprints can be obtained by http://xxx.lanl.gov/abs/astro-ph/0108067
or by contacting afrank@pas.rochester.edu

Magnetized Astrophysical Jets: Cradle to Grave, Source to Effect

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We discuss the propagation of radiative MHD jets and outflows. We focus on outflows driven by magneto-centrifugal rotators. Our goal is to link the properties of the jets with the physics of the sources which produce them. We find that density and magnetic field stratification (with radius) in the jets from magnetized rotators leads to new behavior including the development of a dense inner jet core and a low density collar. We also report on more general studies of ambipolar diffusion and field geometry in pulsed jets. Finally we describe a new work designed to study the effects of magnetized winds on circumstellar environments appropriate to YSOs and PNe.

To be pubslished in Conference Series of Revista Mexicana de Astronomia y Astrofisica

Preprints can be obtained by http://xxx.lanl.gov/abs/astro-ph/0105313 *or by contacting* afrank@pas.rochester.edu

Magnetic Collimation in PNe

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Recent studies have focused on the the role of initially weak toroidal magnetic fields embedded in a stellar wind as the agent for collimation in planetary nebulae. In these models the wind is assumed to be permeated by a helical magnetic field in which the poloidal component falls off faster than the toroidal component. The collimation only occurs after the wind is shocked at large distances from the stellar source. In this paper we re-examine assumptions built into this "Magnetized Wind Blown Bubble" (MWBB) model. We show that a self-consistent study of the model leads to a large parameter regime where the wind is self-collimated before the shock wave is encountered. We also explore the relation between winds in the MWBB model and those which are produced via magneto-centrifugal processes. We conclude that a more detailed examination of the role of self-collimation is needed in the context of PNe studies.

published in ApJ

Preprints can be obtained by http://xxx.lanl.gov/abs/astro-ph/0103096 *or by contacting* afrank@pas.rochester.edu

Jobs

Tenured or Tenure-Track Position in Theoretical Astrophysics University of Washington

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(please, PDF attachments only)
Email Inquiries: office@astro.washington.edu
Attention: Tom Quinn, Chair, Astrophysics Theory Search Committee

Priority will be given to complete applications (with letters) received by 1 November 2001.

The Astronomy and Physics Departments of the University of Washington invite applications for a faculty position in theoretical astrophysics. We seek an exceptional theoretician who will complement and/or expand any existing astrophysical research activities at the University. Areas such as cosmology, star and planet formation and evolution, high-energy, particle, or gravity-wave astrophysics are encouraged; however, applicants from all areas of astrophysical research will be seriously considered. The appointment can be made at the level of Assistant, Associate, or Full Professor in Astronomy, or if appropriate, jointly in the Astronomy and Physics Departments. Please see www.astro.washington.edu and www.phys.washington.edu for more information about both departments.

Responsibilities include pursuing a vigorous program of original research, mentoring Ph.D. students, teaching at the undergraduate and graduate levels, and leadership in curriculum development. Applicants must have a Ph.D. in Astronomy, Physics, or a closely related field, at least one year of postdoctoral employment, and a strong record of original published research. At a minimum, applicants should send a signed cover letter; a three-page statement of research qualifications, major achievements and interests; copies of three best papers; a curriculum vitae; and request three signed letters of reference; all to be mailed directly to "Astrophysics Search" at the address above.

The Astronomy and Physics Departments at U.W. are active, diverse, convivial, and closely linked academic communities committed to long-term programs in and support for theoretical astrophysics. Powerful parallel computational facilities are available for numerical simulation studies such as orbital dynamics, N-body simulations, and magnetohydrodynamic modeling. The newly established Brooks Prize Fellowship program awards postdoctoral positions to outstanding researchers in theoretical astrophysics. Related centers on campus include an interdisciplinary Astrobiology Program, the Institute for Nuclear Theory, and the Center for Experimental Nuclear Physics and Astrophysics. The University of Washington is a leading partner in the Apache Point Observatory 3.5m Telescope and the Sloan Digital Sky Survey.

The University of Washington is building a culturally diverse faculty and strongly encourages applications from women and minority candidates. The University is an Equal Opportunity/Affirmative Action employer.

Jobs

Postdoctoral Position
UMIST, Department of Physics, Manchester, UK

The Astrophysics Group at UMIST in Manchester has an opening for a Postdooctoral Research Assistant in the field of Molecular Astrophysics, starting in January 2002 or as soon as possible thereafter, for a period of at least two years.

The Group, which includes G A Fuller, M D Gray, T J Millar and A A Zijlstra, has research interests in all branches of molecular astrophysics including the physics and chemistry of interstellar clouds and circumstellar regions, maser theory, the properties of interstellar dust and the dynamics of outflows and jets from young stars.

The successful applicant will work with Professor T J Millar and other Group members on the theory and/or observations of protoplanetary disks and/or disks around evolved stars. The Group is actively involved in e-MERLIN, the upgrade to the national facility at Jodrell Bank, and is setting up a Centre for Interferometry and Imaging. Applicants with research experience in this area, or interests in the astrochemical modelling of small-scale structures, are encouraged to apply.

The appointment will be made at the lower end of the PDRA 1A research scale. Applicants should send a letter outlining their research interests, a CV, and the names and addresses of two referees to Professor T J Millar, Department of Physics, UMIST, PO Box 88, Manchester M60 1QD, UK (Tel. +44-(0)161-200-3677, or via e-mail Tom.Millar@umist.ac.uk) before 15 November 2001.

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Further information on the Astrophysics Group can be found on http://saturn.phy.umist.ac.uk:8000.

Conferences

Symbiotic stars probing stellar evolution

27-31 May 2002, La Palma, Canary Islands, Spain

First Announcement

Dear Colleagues,

we are pleased to announce the conference *"Symbiotic stars probing stellar evolution"*, organised by the *Isaac Newton Group of Telescopes (ING)*, to be held on La Palma, Canary Islands, on May 27-31, 2002.

As 6 years will have passed since the last international workshop dedicated to the subject, the conference is aimed at reviewing the state-of-the-art in the field of symbiotic stars, as well to emphasise, for the first time in a comprehensive way, the links to other branches of astrophysics, such as red giants, planetary nebulae, novae, supersoft X-ray sources and supernovae.

To achieve these goals, invited review talks given by leading scientists in all the fields above are planned, as well as a number of contributed talks and posters presenting the recent results on the relevant fields. A preliminary list of invited speakers is: B. Balick (USA), M.F. Bode (UK), R.L.M. Corradi (UK), I. Iben (USA), A. Jorissen (Belgium), M. Livio (USA), J. Mikolajewska (Poland), M. Morris (USA), U. Munari (Italy), H. Nussbaumer (Switzerland), B. Paczynski (USA), H.M. Schmid (Germany), H.E. Schwarz (Chile), E.M. Sion (USA), N. Soker (Israel), P.A. Whitelock (South Africa).
At this time, you can already register on our web page

http://www.ing.iac.es/conferences/symbiotics/

where you will find more information about the conference and the beautiful environment where it will be held.

Financial support from the European Commission is foreseen and will cover a substantial part of the expenses of a number of young ($\leq$ 35 yrs old) researchers from the European Union and Associated States, as well as of researchers with European nationality living outside the EU. Details on these grants and how to apply for them will be announced soon on our Web page.

The deadline for registration and for application for financial assistance support is December 31, 2001. The list of invited speakers, contributed talks etc. will be finalized following this deadline. Note that the total number of participants will be limited to 100, so that early registrations will have the precedence over the latest ones.

This email has been widely distributed, but please make sure your colleagues are aware of this conference.

With best regards,
Romano Corradi & Joanna Mikolajewska (Co-chairs, SOC)
... on behalf of the Scientific Organizing Committee:
M. Bode, R. Corradi, A. Jorissen, M. Livio, J. Mikolajewska, U. Munari, H. Nussbaumer, H.M. Schmid, E. Sion, and P. Whitelock
... and the Local Organising Committee:
R. Miles, R. Corradi, J. Mendez, S. Prins, P. Sorensen, N. Walton, the ING

Contact email: *symbio@ing.iac.es*

IAU SYMPOSIUM 209
Planetary Nebulae: Their Evolution and Role in the Universe

November 19-23, 2001, Canberra, Australia

Web site: http://www.mso.anu.edu.au/pn_symp

Just a brief reminder that registrations for the Symposium close on 15 September.
Registration and accomdation booking is done on the web site.