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Abstract of recently accepted papers

High-resolution observations at $\lambda = 3$ mm of the OH 231.8+4.2 molecular outflow

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We present high spatial resolution observations of HCO^+ (J=1–0), SO ($J=2_2$–1_1), $H^{13}CN$ (J=1–0), SiO (v=1, J=2–1), and the continuum at 3 mm from OH 231.8+4.2, taken with the IRAM interferometer at Plateau de Bure. We also report the first detection of NS in circumstellar envelopes. The overall distribution of the emission of all molecules (except for HCO^+ and the SiO maser) is similar to that of CO. The most intense emission arises from a compact, slowly-expanding component around the central star. The rest of the emission comes from gas distributed in a narrow region along the symmetry axis, that flows outwards following a velocity gradient also similar to that found in CO. Our observations show with high accuracy the distribution of the HCO^+ intensity, that is found to be very clumpy and strongly enhanced in the shock-accelerated lobes. We argue that such a distribution is due to the efficient formation of this molecule by shock-induced reactions. An expanding disk or ring around the central star is detected from the SO emission. The characteristic radius and expansion velocity of this structure are 2×10^{16} cm and 6–7 km s^{-1}, respectively. The SiO maser emission could arise from the innermost parts of such a disk. The 3 mm continuum emission seems to be due to cold dust (~ 20 K) distributed in the lobes of OH 231.8+4.2 as well as from warmer (~ 55 K) dust located in a compact region surrounding the central star.

Accepted by A&A

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On the origin of thin detached gas shells around AGB stars Insights from time-dependent hydrodynamical simulations

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We have applied two different computer codes to study the time-dependent hydrodynamics of circumstellar gas/dust shells of AGB stars in their final stages of evolution. A two-component radiation hydrodynamics code is designed to model a stellar wind driven by radiation pressure on dust grains. Combined with detailed stellar evolution calculations, this approach allows us to simulate the dynamical response of the AGB wind envelope

and the emergent spectral energy distribution to temporal changes of the stellar luminosity and mass loss rate. A completely independent one-component, Godunov-type hydrodynamics code, which is particularly well suited to resolve shock fronts, is used to check the results obtained with the numerically more diffusive two-component code.

First, we verify that a presumed short episode of high mass loss translates into a correspondingly narrow, high-density shell moving through the circumstellar envelope, provided that the mass loss rate, and hence the outflow velocity, is essentially constant during the mass ejection. In principle, this scenario remains a viable explanation for the existence of the very thin molecular shells recently detected around some carbon–rich AGB stars.

Second, we discovered that an alternative mechanism producing very thin shells of greatly enhanced gas density can operate in the dusty outflows from AGB stars: the interaction of a faster inner wind running into a slower outer wind, sweeping up matter at the interface between both type of winds. Based on different numerical simulations and on a simple analytical model, we show that this mechanism easily leads to the formation of very thin shells without the need to invoke large variations of the mass loss rate on very short time scales.

Finally, we demonstrate that a typical helium-shell flash induces both a mass loss 'eruption' and a two-wind interaction due to the increased outflow velocity during the high mass loss phase, leading to the formation of a thin compressed gas shell. Very likely, this mechanism is responsible for the origin of the CO shells found around some semiregular, optically visible carbon stars, the most prominent example being TT Cygni.

Accepted by Astronomy & Astrophysics

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Infrared classification of galactic objects

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Unbiased analysis shows that IRAS data reliably differentiate between the early and late stages of stellar evolution because objects at these stages clearly segregate in infrared color-color diagrams. Structure in these diagrams is primarily controlled by the density distribution of circumstellar dust. The density profile around older objects is the steepest, declining as r^{-2}, while young objects have profiles that vary as $r^{-3/2}$ and flatter. The different density profiles reflect the different dynamics that govern the different environments. Our analysis also shows that high mass star formation is strongly concentrated within ~ 5 kpc around the Galactic center, in support of other studies.

Accepted by ApJ Letters

For preprints, contact moshe@pa.uky.edu or ftp://gradj.pa.uky.edu/moshe/IRAS_scaling.ps

Circumstellar dust shells around long-period variables VII. The role of molecular opacities

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The role of molecular opacities for the structure and dynamics of winds of carbon-rich AGB stars is investigated in the frame work of time-dependent hydrodynamic models of dust forming circumstellar shells around cool pulsating stars. New Rosseland and Planck mean gas opacity tables have been calculated for $T \epsilon$ [500K, 10 000K] and $n_{<\mathrm{H}>} \epsilon$ [$10^5\mathrm{cm}^{-3}, 10^{15}\mathrm{cm}^{-3}$] for solar, LMC and SMC abundances. Carbon-rich, static and time-dependent models have been computed using either the Planck mean or the Rosseland mean for solar and LMC

metalicity or a constant gas opacity ($\chi^{\rm g} = 2 \cdot 10^{-4}{\rm cm}^2{\rm g}^{-1}$, Bowen 1988). In the model calculations, a large gas opacity (Planck mean) generally causes a less dense atmosphere than a small gas opacity (Rosseland mean, constant gas opacity) which leads to smaller amounts of dust formed, and consequently to smaller mass loss rates $\langle \dot{M} \rangle$, lower terminal wind velocities $\langle v_\infty \rangle$ and lower dust-to-gas ratios $\langle \rho_{\rm dust}/\rho_{\rm gas} \rangle$. Models with lower metalicity (LMC) form by far the smallest amount of dust and show therefore the lowest $\langle \dot{M} \rangle$, $\langle v_\infty \rangle$, and $\langle \rho_{\rm dust}/\rho_{\rm gas} \rangle$. Counteracting to the global density reduction due to strong gas absorption, the density might LOCALLY increase due to a pressure inversion. These pressure inversions are preserved even in the hydrodynamic models where the atmosphere is disturbed by the propagation of shock waves. Due to the present determination of the temperature structure by grey opacities in the time-dependent models, the occurrence of pressure inversions deserves, however, further investigations by means of a more elaborate treatment of the radiative transfer in dynamic model atmospheres.

Accepted by A&A

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Parameters of Dust Shell of Proto-Planetary Nebula IRAS 18062+2410

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The spectral energy distribution of the proto-planetary nebula IRAS 18062+2410 from near UV to far IR is fitted using the dust radiative transfer model for a spherically symmetric shell. The parameters of central star have been determined by Arkhipova V.P. et al.(Astron. Lett. 1999. V.25. P.25). The luminosity is found to be 10000 $L_\odot$ and the effective temperature is equal 25000 K. The model assumes a single grain size with the radius of spherical grain 0.10 micron. For the dust composition a silicate is assumed, whose complex dielectric function is determined by David P. and Pegourie B. (A&Ap. 1995. V.293. P.833.).

The derived model parameters are: distance, 6400 pc; inner shell radius, 0.0014 pc; temperature of the dust at the inner radius, 410 K; dust number density at this radius, $2.7 \times 10^{-7} cm^{-3}$; optical dept of the dust shell at wavelength 10.0 micron, 0.050.

The estimate of the dust shell expansion velocity 12 km s^{-1} is obtained using the evolution model calculations data of Blocker T.(A&Ap. 1995. V.299. P.755). For this value of velocity the dust mass-loss rate is $1.8 \times 10^{-8} {\rm M}_\odot\,{\rm yr}^{-1}$. If we adopt the gas-to-dust mass ratio to be 250, then total mass-loss rate at moment of leaving of the AGB reached $4.5 \times 10^{-6} {\rm M}_\odot\,{\rm yr}^{-1}$.

Accepted by Astronomy Reports

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Radio Continuum and HI Observations of the Remarkable Planetary Nebula KjPn 8

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We present Very Large Array (VLA) continuum observations of the core of KjPn 8 made with arc second angular resolution and taken at three epochs over a period of 2.8 years. The radio appearance of the planetary nebula seems to have experienced changes, tentatively attributed to variable illumination coming from the nucleus. We also present VLA observations of atomic hydrogen toward this source, made with an angular resolution of about 40″. We detect associated emission that suggests the presence of a mass of atomic hydrogen of order 0.07 $M_\odot$ in the envelope.

Accepted by Revista Mexicana de Astronomía y Astrofísica

Preprints can be obtained by contacting luisfr@astrosmo.unam.mx
or via WWW on http://www.astrosmo.unam.mx/~luisfr/publ.html

Knots in the outer shells of the planetary nebulae IC 2553 and NGC 5882

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We present images and high-resolution spectra of the planetary nebulae IC 2553 and NGC 5882. Spatio-kinematic modeling of the nebulae shows that they are composed of a markedly elongated inner shell, and of a less aspherical outer shell expanding at a considerably higher velocity than the inner one.
Embedded in the outer shells of both nebulae are found several low-ionization knots. In IC 2553, the knots show a point-symmetric distribution with respect to the central star: one possible explanation for their formation is that they are the survivors of pre-existing point-symmetric condensations in the AGB wind, a fact which would imply a quite peculiar mass-loss geometry from the giant progenitor. In the case of NGC 5882, the lack of symmetry in the distribution of the observed low-ionization structures makes it possible that they are the result of in situ instabilities.

Accepted by The Astrophysical Journal.

Preprints can be obtained by contacting rcorradi@ing.iac.es
or via WWW on http://andromeda.roque.ing.iac.es/~sanchez/ingpub/index2000.html

A Galactic Bar to Beyond the Solar Circle and its Relevance for Microlensing

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The Galactic kinematics of Mira variables have been studied using infrared photometry, radial velocities, and Hipparcos parallaxes and proper motions. For Miras in the period range 145 to 200 days (probably corresponding to [Fe/H] in the range –0.8 to –1.3) the major axes of the stellar orbits are concentrated in the first quadrant of Galactic longitude. This is interpreted as a continuation of the bar-like structure of the Galactic Bulge out to the solar circle and beyond.

To appear in: Microlensing 2000, ASP Conference Series, Eds. J W Menzies, P Sackett.

For preprints, contact paw@saao.ac.za *or via WWW on* http://xxx.lanl.gov/abs/astro-ph/0004108

Solar-like cycle in asymptotic giant branch stars

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I propose that the mechanism behind the formation of concentric semi-periodic shells found in several planetary nebulae (PNs) and proto-PNs, and around one asymptotic giant branch (AGB) star, is a solar-like magnetic

activity cycle in the progenitor AGB stars. The time intervals between consecutive ejection events is $\sim 200 - 1,000$ yr, which is assumed to be the cycle period (the full magnetic cycle can be twice as long, as is the 22-year period in the sun). The magnetic field has no dynamical effects; it regulates the mass loss rate by the formation of magnetic cool spots. The enhanced magnetic activity at the cycle maximum results in more magnetic cool spots, which facilitate the formation of dust, hence increasing the mass loss rate. The strong magnetic activity implies that the AGB star is spun up by a companion, via a tidal or common envelope interaction. The strong interaction with a stellar companion explains the observations that the concentric semi-periodic shells are found mainly in bipolar PNs.

ApJ, in press.

Preprints can be obtained by contacting soker@physics.technion.ac.il

or via WWW on http://xxx.lanl.gov/abs/astro-ph/0001281 (This is an astro-ph/0001281 earlier version, prior to the referee report)

Mass Loss during Late Stellar Evolution

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Extensive post-main sequence mass loss occurs for low and intermediate mass stars on the asymptotic giant branch (AGB), and for the higher mass stars during their red supergiant evolution. These winds affect the evolution of the stars profoundly, as well as the enrichment of the interstellar medium with heavy elements and grain particles. The mass loss on the AGB is the by far the most well studied, but the basic processes are still not understood or cannot be described in a proper quantitative way, e.g., the mass loss mechanism itself. These objects also provide us with fascinating systems, in which intricate interplays between various physical and chemical processes take place, and their relative simplicity in terms of geometry, density distribution, and kinematics makes them excellent astrophysical laboratories. In this review I will concentrate on the aspects of AGB mass loss which are of particular interest in connection with the ALMA.

Invited review in Proceedings of the conference Science with the Atacama Large Millimeter Array, Washington, October 1999

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Observational investigation of mass loss of M supergiants

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We present the analysis of infrared photometry and millimeter spectroscopy of a sample of 74 late-type supergiants. These observations are particularly suitable to study the mass loss and the circumstellar envelopes of evolved massive stars. In particular, we quantify the circumstellar infrared excess, the relation of mass loss with stellar properties, using the K-[12] colour index as mass-loss indicator. We do not find any clear correlation between mass loss rate and luminosity. We also show that the K-band magnitude is a simple luminosity indicator, because of the relative constancy of the K-band bolometric correction.

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VLBI Astrometry of the Stellar Image of U Herculis, Amplified by the 1667 MHz OH Maser

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The OH 1667 MHz maser in the circumstellar shell around the Mira variable U Her has been observed with the NRAO Very Long Baseline Array (VLBA) at 6 epochs, spread over 4 years. Using phase referencing techniques the position of the most blue-shifted maser spot was monitored with respect to two extra-galactic radio sources. The absolute radio positions of the maser can be compared with the stellar optical position measured by the Hipparcos satellite to 15 mas accuracy. This confirms the model in which one of the maser spots corresponds to the stellar continuum, amplified by the maser. The stellar proper motion and the annual parallax ($\pi_{\rm VLBI} = 5.3 \pm 2.1$ mas) were measured.

Accepted by A&A.

Preprints can be obtained by contacting vlemming@strw.leidenuniv.nl

He2-113: a multipolar planetary nebula with rings around a cool Wolf-Rayet star

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We present Hα imaging and molecular-line (CO) observations of He2-113, an object which belongs to a rare class of planetary nebulae with Wolf-Rayet type central stars. The Hα images, obtained with the Hubble Space Telescope Wide-Field Planetary Camera 2, show that He2-113 has an overall bipolar shape, and two bright, knotty, compact ring-like structures around the central star. The major bipolar axis and the axis of symmetry of the rings are not co-linear. A third, smaller, lobe is found to extend along an axis different from both of the above. The central star of He2-113 is conspicuously offset from the geometrical centers of the rings and the main bipolar lobes. A faint extended round halo surrounds the bipolar nebula, probably representing the spherical mass-loss phase of the progenitor AGB red giant. The CO data indicate that this halo is mostly neutral and expanding at 28 km s^{-1}; an extended weak blue wing indicates that some of the molecular gas has been accelerated to significantly larger velocities. Self-consistent modelling of the CO data and IRAS far-infrared flux, including heating-cooling to calculate the gas kinetic temperature, shows that the mass-loss rate of the progenitor AGB star is relatively high ($\sim 10^{-4}\,M_\odot$ yr^{-1}), and that the molecular gas is relatively cold.

The very aspherical morphology of the He2-113 nebula may allow ionising radiation to escape preferentially from the nebula along directions with relatively low optical depth. The observed nebular structure is not consistent with the generalised interacting winds model of planetary nebula formation. The multi-lobed structure supports a new model by Sahai & Trauger in which collimated outflows with changing directionality are the primary agent for the shaping of planetary nebulae. The origin of the rings and the offset of the central star remain puzzling.

Accepted by The Astrophysical Journal

Preprints can be obtained by contacting sahai@grandpa.jpl.nasa.gov
or via WWW on http://wfpc2.jpl.nasa.gov/~idt/sahai.html

The Starfish twins : two young planetary nebulae with extreme multipolar morphology

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We present Hα images of two objects, He2-47 and M1-37, obtained during a Hubble Space Telescope imaging survey of young planetary nebulae (PNs) selected on the basis of their low excitation characteristics. The two objects show a highly aspherical morphology, characterised by multiple lobes distributed around the central star. Such a morphology has never been seen before in any astrophysical setting. Bright structures near the minor axes indicate the presence of dense equatorial torii (seen edge-on in M1-37, and as partial elliptical rings in He2-47). In both nebulae, the central star is found to be offset from the geometrical center of symmetry of the waist region. The multiple lobes of He2-47 and M1-37 have been produced fairly recently (few hundred years ago), based on rough estimates of their expansion ages. The extreme multipolar morphology of these PNs supports the recent hypothesis of Sahai and Trauger that the primary agent for shaping PNs are high-speed collimated outflows which operate during the late AGB and/or early post-AGB evolutionary phase; these outflows either change their direction episodically, and/or multiple collimated outflows with different axes operate (quasi)simultaneously. Drastic modifications of existing theories or completely new ideas are needed in order to obtain a full understanding of the salient morphological features of He2-47 and M1-37.

Accepted by The Astrophysical Journal (Letters)

Preprints can be obtained by contacting sahai@grandpa.jpl.nasa.gov
or via WWW on http://wfpc2.jpl.nasa.gov/~idt/sahai.html

Stellar Iron Abundances at the Galactic Center

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We present measurements of [Fe/H] for six M supergiant stars and three giant stars within 0.5 pc of the Galactic Center (GC) and one M supergiant star within 30 pc of the GC. The results are based on high-resolution ($\lambda/\Delta\lambda$ = 40,000) $K-$band spectra, taken with CSHELL at the NASA Infrared Telescope Facility. We determine the iron abundance by detailed abundance analysis, performed with the spectral synthesis program MOOG. The mean [Fe/H] of the GC stars is determined to be near solar, [Fe/H] = $+0.12 \pm 0.22$. Our analysis is a *differential* analysis, as we have observed and applied the same analysis technique to eleven cool, luminous stars in the solar neighborhood with similar temperatures and luminosities as the GC stars. The mean [Fe/H] of the solar neighborhood comparison stars, [Fe/H] = $+0.03 \pm 0.16$, is similar to that of the GC stars. The width of the GC [Fe/H] distribution is found to be narrower than the width of the [Fe/H] distribution of Baade's Window in the bulge but consistent with the width of the [Fe/H] distribution of giant and supergiant stars in the solar neighborhood.

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Preprints can be obtained by contacting solange@astronomy.ohio-state.edu
or via WWW on http://www.astronomy.ohio-state.edu/~solange/paper.html

Complex wind dynamics and ionization structure in symbiotic binaries

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Aspects of the wind-dynamics in symbiotic binaries, colliding winds and accretion, are reviewed. Inconsistencies between theory and observations of the hot star wind are discussed. If the hot star wind were governed by CAK theory, nearly all symbiotics would be colliding wind binaries. For the case of colliding winds, 3D hydrodynamical simulations reveal that the matter distribution is spirally shaped. Shock confined high-density shells as well as huge voids are found even in the immediate neighborhood of the stars. Synthetic spectra computed on the basis of different 3D hydrodynamical models suggest observational discrimination between them to be possible. Colliding wind models also provide a link between symbiotics and planetary nebulae. Accretion during some time is a necessary condition for symbiotics to exist. However, there is no proof of whether currently accreting systems show the symbiotic phenomenon. Existing accretion models are inconsistent amongst each other, predicting either extended disks or small, high-density accretion wakes. Synthetic spectra allowing to discriminate between two models do not yet exist.

Invited review at the Conference on Thermal and Ionization Aspects of Flows from Hot Stars: Observations and Theory

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Optical spectrum of the bipolar nebula AFGL 2688

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Using CCD spectra obtained with the echelle-spectrometer in the prime focus of the 6 m telescope, we have first determined the detailed chemical composition for one of components of the bipolar nebula identified with the strong IR–source AFGL 2688 by the model atmospheres method.
The iron abundance of AFGL 2688, [Fe/H] $= -0.59$ dex, indicates that this object belongs most likely to the moderate population of the Galaxy.
Carbon and nitrogen have been found to be high overabundant in the atmosphere of the star ([C/Fe] $= +0.73$, [N/Fe] $= +2.00$, C/O > 1), which confirms its post–AGB evolution stage.
But the excess revealed for s–process elements (yttrium and barium) relative to iron is not so large, [X/Fe] $= +0.55$. The abundances of lanthanides are even less enhanced: for La, Ce, Pr, Nd the average value of [la/Fe] $= +0.26$ dex. Such a pattern for heavy metals agrees with the low intensity of the 21 μ band in the IR–spectrum of AFGL 2688. Intensity of this emission feature is very high in the spectra of all studied PPN with a strong excess of s–process elements.
Analysis of radial velocity values determined from spectral details formed both in the photosphere and in the circumstellar envelope permits us to reveal a high-velocity component (about 60 km/sec) of the stellar wind.

Accepted by Astronomy Letters

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ISO impact on stellar models and vice versa

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We present a detailed spectroscopic study of a sample of standard stars based on ISO-SWS data, which enables the accurate determination of their atmospheric parameteres, but also serves as a critical review of the ISO-SWS calibration.

This study is situated in a broader context of an iterative process in which both accurate observations of stellar templates and cool star atmosphere models are involved to improve the ISO-SWS calibration process as well as the theoretical modeling of stellar atmospheres. Therefore a sample of stars, covering the whole A0 - M8 spectral classification, has been observed in order to disentangle calibration problems and problems in generating the theoretical models and corresponding synthetic spectrum.

The discrepancies between the observed ISO-SWS and synthetic spectra are subjected to a careful scrutiny in order to elucidate their origin. At this point, a distinction can be made between discrepancies typically for *hot* stars ($T_{\rm eff} > 5700$ K) and those typically for *cool* stars. Stellar objects belonging to the *cool* stars display molecular features in their spectrum, while those belonging to the *hot* stars do not. A description on the general trends in the discrepancies for both *hot* and *cool* stars is made and we have demonstrated that one can pin down the stellar parameters of the cool giants very accurately from the moderate resolution ISO-SWS data.

To appear in the Proceedings of the Conference 'ISO beyond the Peaks', Villafranca del Castillo, Spain, 2-4 February 2000

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86-GHz SiO Masers Toward Mira

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We observed the $v = 1, J = 2 \rightarrow 1$, 86-GHz SiO maser transition from Mira (o Ceti) near a stellar pulsation phase $\phi = 0.3$ with the Coordinated Millimeter VLBI Array (CMVA). Maser emission was detected on two of the baselines, and general size and brightness parameters were extracted. For this epoch (1998.26), we find that the maser features extend over roughly 1.5 to 2 $R_\star$ in the north-south direction. The limited image fidelity was insufficient to assess whether a ring-like morphology typical of other evolved stars with SiO masers appears in Mira also. The brightness temperatures ($\leq 10^{10.5}$K) and spot sizes ($\geq 0.''001$) generally resemble those of other maser sources measured by VLBI at 86 GHz such as VX Sgr and R Cas. We find no coherent velocity structure suggested by the 86-GHz SiO masers toward Mira.

Accepted by The Astronomical Journal

Preprints can be obtained by contacting rbp@mustang.haystack.mit.edu

Bow-shocks and possible Jet-shell interaction in the Planetary Nebula M 2-48

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Deep narrow band CCD images in the Hα, [O III] λ5007 Å, [N II] λ6584 Å, and [S II] λ6717 + 31 Å emission lines have been obtained for the planetary nebula M 2-48. The discovery of a pair of symmetric low-excitation bow-shocks, separated by $4'$, and forming a highly collimated bipolar outflow, is presented. The bow-shocks are emitting in [O III] and present the ionization structure expected from working surfaces of collimated jets, pointing out that these structures are tracing regions with shocked gas at high velocities ($> 100\,\mathrm{km\,s^{-1}}$). In addition, an internal bipolar outflow ($60'' \times 30''$) and an apparent off-center semi-circular shell (size $\approx 110''$) are also detected. An enhancement of low-excitation line emission is observed in the shell along the outflow axis. This result can be interpreted in terms of a jet-shell interaction.

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Preprints can be obtained by contacting vazquez@astrosen.unam.mx

Modeling emission lines of 8 northern planetary nebulae

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In order to constrain the nebular density distribution and velocity field, we model nebular lines profiles obtained at very high spectral resolution. The method and computer code applied to 2–3 nebular lines were described in earlier publications. In the present work we analyse 4–11 spectral lines observed simultaneously with the spectrometer ELODIE (R=42 000) for 8 planetary nebulae. For five analyzed nebulae with a [WC]-type nucleus, we found highly broadened profiles implying possible turbulent motions.

Accepted by A&A

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Abstract of recently completed dissertations

Infrared Spectroscopic Investigations of Stellar Winds from Red Giants

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Ph.D dissertation directed by: Professor Bengt Gustafsson and Docent Kjell Eriksson

Ph.D degree awarded: March, 31 2000

Spectroscopic investigations of stellar winds from red giants are of interest for several reasons. The discussion on the cosmic build-up of elements needs information based on such investigations. Asymptotic Giant Branch (AGB) stars have a large mass loss which expels newly synthesised elements and enriches the interstellar medium from which a new generation of stars is formed. The circumstellar envelopes of AGB stars are also of interest in their own right. In recent years it has been possible to extend this research into the infrared wavelength regions as a result of the recent developments in space and detector technology. In our work, new infrared probes of the physical conditions in the envelopes surrounding AGB stars have been shown to be useful tools in the study of stellar winds.

The detection of gaseous, circumstellar CO_2 has initiated a discussion concerning the wind regions very close to AGB stars. It is suggested that the CO_2 bands probably are formed in two separate parts of the envelopes at different distances from the star.

More information on the circumstellar envelopes can be obtained by simultaneously modelling radio and far-IR observations of CO rotational lines, in a fashion resembling archaeology, studying different layers of the envelopes at different wavelengths. This method was applied for the first time to IRAS 15194-5115, a star of unknown evolutionary status. The history of the mass-loss rate of AGB stars is imprinted in the circumstellar envelopes and its variations can be studied and can provide clues to the evolutionary stage of the star.

Another way of studying the winds is to investigate spatially resolved, photospheric light scattered in infrared, vib-rot lines of CO, such as the observations of the circumstellar envelope of the AGB star Mira Ceti. The discussion and modelling of these observations has shed some light onto the inner regions ($\lesssim 100\,R_*$) of the winds, for which little observational knowledge is available today. The scientific approach of combining observations (of high spectral and spatial resolution) of vib-rot transitions of CO, radio and FIR observations with a circumstellar wind model has proved to be powerful. Thus, further investigations along the same lines as those discussed in this thesis would certainly be rewarding.

Thesis-related Publications: Ap&SS, 255, 301; A&A, 341, 579; A&A, 345, 841; A&A, 347, L35

Messages

Release of the INES Archive

The International Ultraviolet Explorer (IUE) Archives have been delivered to the world scientific community on 21st March. ESA, in collaboration with the Spanish Laboratory of Space Astrophysics and Theoretical Physics (LAEFF) belonging to INTA (National Institute of Air and Space Technology), has developed and set up the INES system to access IUE Data.

INES (IUE Newly Extracted Spectra) is a complete astronomical archive and data-distribution system. Its release to the community represents the final activity by ESA in the context of the IUE project. From now LAEFF, on behalf of the international astronomical community, will be responsible of maintaining INES, making it available and providing world-wide support to scientists using IUE data.

The IUE Archive contains more than 110,000 spectra of more that 11,000 astronomical objects. All data are fully reduced and calibrated. The INES archive consists of:
an access catalog containing the parameters required to query the archive and evaluate the observations,
a publications catalog which links each spectrum to the publications in which it has been used via the ADS, * and the data themselves (low dispersion spectra, high dispersion spectra rebinned to the low resolution wavelength step, full high dispersion concatenated spectra, and bi-dimensional low dispersion images).

The INES Archive can be accessed at http://ines.vilspa.esa.es. Users can consult the catalogue, preview the spectra and download the data with a standard browser from the Principal Centre at LAEFF, its Mirror Centre located at the Canadian Astronomical Data Centre or any of the National Centres spread in all continents. This distributed system guarantees the availability and efficient access to the data.

Questions about the INES archive can be directed to the INES Help Desk at
ineshelp@iuearc.vilspa.esa.es or at http://iuearc.vilspa.esa.es/ines_jb/HelpDesk/.

2MASS Second Incremental Data Release

The Two Micron All Sky Survey (2MASS) Second Incremental Data Release is now available for public access. This Release includes data from the northern and southern 2MASS facilities, covering 47% of the sky. The Release data products consist of a Point Source Catalog containing positions and photometry for over 162 million objects, an Extended Source Catalog containing positions, photometry and basic shape information for over 585,000 resolved sources, approximately 1.9 million compressed 512×1024 pixel ($1''$/pixel) images in the three Survey bandpasses, and non-compressed "postage-stamp" images for all of the Extended Source Catalog objects.

The release data products can be accessed on-line from the IPAC/2MASS Web site at
http://www.ipac.caltech.edu/2mass/ or directly from the NASA/Infrared Science Archive site at
http://irsa.ipac.caltech.edu/.
In the near future, the release Catalogs will be available via ftp download, and on a limited distribution DVD-ROM. Access to the 2MASS Atlas Images is currently possible only via the on-line services.

The 2MASS/IPAC webpage contains general information about this data release, including an on-line Explanatory Supplement (http://www.ipac.caltech.edu/2mass/releases/second/doc/explsup.html), sky coverage maps, images of interesting objects in the release, catalog characteristics, etc. A tool for determining whether a specified position is included in the release area is available on the NASA/Infrared Science Archive webpage. Questions about the release can be directed to the 2MASS Help Desk at 2mass@ipac.caltech.edu.

We encourage you to notify us (at 2mass@ipac.caltech.edu) about any refereed publications or conference proceedings (even in preprint form) which make use of these or earlier 2MASS Release data products. We will gladly provide links to your papers from the 2MASS website. Thank you very much in advance.

The Two Micron All Sky Survey is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology. Funding for the survey has been provided by the National Aeronautics and Space Administration and the National Science Foundation.

New Jobs

Postdoctoral Research Position in Post-AGB Stars at Valparaiso University

Applications are invited for a postdoctoral research position to participate with Prof. Bruce Hrivnak in the study of post-AGB, proto-planetary nebula objects. It is expected that the successful candidate will have a research background in this or a related area. The position will involve observation, data reduction, and analysis of HST and ground-based imaging and spectroscopic data. An expertise in using IRAF is required. The position is for one year beginning fall 2000, with the possibility of a second year contingent upon additional funding and satisfactory performance. Candidates must possess a Ph.D. in Astronomy/Astrophysics by the starting date. Information on the Department and the University is located at http://physics.valpo.edu.

Applicants should send a curriculum vitae, statement of research interests, and publication list, and arrange for three letters of recommendation to be sent directly to Prof. Hrivnak at the following temporary address:
Prof. Bruce Hrivnak
Steward Observatory, University of Arizona
933 N. Cherry Avenue
Tucson, AZ 85721-0065
USA

Email inquiries can be made to Prof. Hrivnak at bruce.hrivnak@valpo.edu. Consideration of applicants will begin April 10, 2000. AEE/EOE

Postdoctoral Research Position at IAC

informations on : http://www.iac.es/gabinete/inves/postdoc1.htm
deadline : June 9

UMIST Department of Physics
LECTURESHIP IN ASTROPHYSICS

Applications are invited for the above tenured post in the Department of Physics. We are seeking a dynamic individual with a strong research record and interests to complement and extend those of the current members of the Astrophysics Group (T J Millar, G A Fuller and A A Zijlstra). Research interests of the Group, which are supported by three PPARC Rolling Grants, include astrochemistry, high and low mass star formation, interstellar and circumstellar matter, and the late stages of stellar evolution. We are interested particularly in candidates with a background in theoretical aspects of molecular astrophysics, including hydrodynamics, although some experience in observational astrophysics is also welcomed. The appointee will be expected to play a role in the development of astrophysics courses for undergraduates in physics. The Department of Physics has undergone a period of expansion in recent years and contains five internationally recognised research groups with a sixth group in Biomolecular Physics in the process of being established.

It is hoped that the successful candidate can be in post by 1 August 2000 but a slightly later appointment may be possible by mutual consent. Informal enquiries may be made to Professor T J Millar on +44-(0)161-200-3677, or via e-mail to Tom.Millar@umist.ac.uk. Information on Astrophysics at UMIST may be found on the WWW at: http://saturn.phy.umist.ac.uk:8000/.

Commencing salary (under review) will be within the Lecturer A or B scale (17,238 - 30,065 pounds sterling per annum).

Application form and further details are available from: The Personnel Office, UMIST, P O Box 88, Manchester M60 1QD, UK (phone +44-(0)161-200-4058, fax +44-(0)161-200-4037, or via e-mail to Rachel.Peacock@umist.ac.uk). The closing date for applications is **15 May 2000**. Please quote reference: PHY/A/102.
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