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Abstract of recently accepted papers

Dust Shell of Symbiotic Nova HM Sagittae

M.B. Bogdanov[1] *and Olga G. Taranova*[2]

[1] Saratov State University, Bolschaya Kazachiya st. 112a, Saratov, 410026 Russia

[2] Sternberg Astronomical Institute, Universitetskii pr. 13, Moscow, 119899 Russia

The variations of light and color of HM Sge are investigated based on the data of our photometric observations in visible and near infrared acquired over many years. The models of a spherically symmetric dust shell were fitted to low resolution mid-infrared stellar spectra observed by IRAS (the middle 1983) and ISO (October 1, 1996) using the DUSTY (version 2.0) code. For the grain size distribution we adopted the standard MRN model. The dust composition was accepted to be the warm silicate, and the grain number density $n(r) \propto r^{-2}$. Two extreme cases of dust heating were examined: by the Mira variable only (model 1), and by a summary radiation of both hot and cold component ignoring the absorption of short-wave quanta in a gas envelope (model 2). It is shown that the observational data can be well represented only by the model 1. The derived parameters of this model are (in brackets from the ISO data): the luminosity of the Mira variable, $10600 L_\odot$; the effective temperature, 2600 K; the optical depth of the dust shell at wavelength 0.55 micron, 10.1 (12.5); the inner shell radius, $3.42(5.85) \times 10^{14}$ cm; the temperature of the dust at inner radius, 900 (700) K; the distance, 2.0 (2.6) kpc; the velocity of the stellar wind, 11.2 (8.3) $\mathrm{km\,s^{-1}}$; the upper limit of the mass of a central body, $2.0(2.0) M_\odot$; the total mass-loss rate, $1.0(1.5) \times 10^{-5} M_\odot\,\mathrm{yr^{-1}}$. It is possible that the variations of the dust shell parameters are connected with an evolution of the hot component. The observed decrease of its luminosity is favorable to the formation of dust grains in atmosphere of the Mira variable.

Accepted by Astronomy Reports

Preprints can be obtained by contacting taranova@sai.msu.ru

Morphology and Galactic Distribution of PNe: a New Scenario

G. García-Segura, J. Franco, J. A. López, N. Langer and M. Różyczka

We review recent works on morphology and galactic distribution of planetary nebulae (PNs), as well as recent advances in MHD modeling of PNs. We arrive to a tentative explanation for the connection between morphological classes and galactic distribution.

2001, RMxAASC, in press

Preprints can be obtained via WWW on http://arXiv.org/abs/astro-ph/0102044

SiO emission from a huge, detached shell in IRC +10420

A. Castro-Carrizo[1], *R. Lucas*[2], *V. Bujarrabal*[1], *F. Colomer*[1] *and J. Alcolea*[1]

[1] Observatorio Astronomico Nacional (IGN), Apdo. 1143, E-28800 Alcalá de Henares, Spain

[2] IRAM, 300 rue de la Piscine, F-38406 St Martin d'Hères, France

We present observations of the v3D0 J3D2–1 thermal emission of SiO from the very luminous evolved star IRC +10420, performed with the Plateau de Bure interferometer. Our high-resolution maps show that the emission comes from a huge hollow shell, with a typical radius of $\sim 10^{17}$ cm, that is expanding at ~ 35 km s^{-1} This surprising result is strengthened by model fitting of the flux distribution, that explains the observations assuming that the width of the shell is not larger than half its typical radius. The origin of this feature is discussed.

Accepted by Astronomy & Astrophysics Letters

Preprints can be obtained by contacting carrizo@oan.es
or via WWW on http://www.oan.es/preprints

Analysis of Stars Common to the IRAS and HIPPARCOS Surveys

T.G. Knauer[1], *Ž. Ivezić*[2] *and G.R. Knapp*[2]

[1] University of Kentucky

[2] Princeton University

For about 11,000 stars observed in the HIPPARCOS Survey and detected by IRAS we calculate bolometric luminosities by integrating their spectral energy distributions from the B band to far-IR wavelengths. We present an analysis of the dependence of dust emission on spectral type and correlations between the luminosity and dust emission for about 1000 sources with the best data (parallax error less than 30%, error in luminosity of about 50% or better). This subsample includes stars of all spectral types and is dominated by K and M giants.

We use the IRAS [25]-[12] color to select stars with emission from circumstellar dust and show that they are found throughout the Hertzsprung-Russell diagram, including on the main sequence. Clear evidence is found that M giants with dust emission have luminosities about 3 times larger (about 3000 $L_\odot$) than their counterparts without dust, and that mass loss on the asymptotic giant branch for both M and C stars requires a minimum luminosity of order 2000 $L_\odot$. Above this threshold the mass-loss rate seems to be independent of, or only weakly dependent on, luminosity. We also show that the mass-loss rate for these stars is larger than the core mass growth rate, indicating that their evolution is dominated by mass loss.

Accepted by ApJ.

Preprints can be obtained via WWW on http://xxx.lanl.gov/abs/astro-ph/0102216

100-year Mass Loss Modulations on the Asymptotic Giant Branch

M. Marengo, Ž. Ivezić[2] *and G.R. Knapp*[2]

[1] Harvard University

[2] Princeton University

We analyze the differences in infrared circumstellar dust emission between oxygen rich Mira and non-Mira stars, and find that they are statistically significant. In particular, we find that these stars segregate in the K-[12] vs. [12]-[25] color-color diagram, and have distinct properties of the IRAS LRS spectra, including the peak position of the silicate emission feature. We show that the infrared emission from the majority of non-Mira stars cannot

be explained within the context of standard steady-state outflow models. The models can be altered to fit the data for non-Mira stars by postulating non-standard optical properties for silicate grains, or by assuming that the dust temperature at the inner envelope radius is significantly lower (300-400 K) than typical silicate grain condensation temperatures (800-1000 K). We argue that the latter is more probable and provide detailed model fits to the IRAS LRS spectra for 342 stars. These fits imply that 2/3 of non-Mira stars and 1/3 of Mira stars do not have hot dust (> 500 K) in their envelopes. The absence of hot dust can be interpreted as a recent (order of 100 yr) decrease in the mass-loss rate. The distribution of best-fit model parameters agrees with this interpretation and strongly suggests that the mass loss resumes on similar time scales. Such a possibility appears to be supported by a number of spatially resolved observations (e.g. recent HST images of the multiple shells in the Egg Nebula) and is consistent with new dynamical models for mass loss on the Asymptotic Giant Branch.

Accepted by MNRAS.

Preprints can be obtained via WWW on http://xxx.lanl.gov/abs/astro-ph/0102217

Turbulent outflows from [WC]-type nuclei of planetary nebulae: II. The [WC 8] central star of NGC 40

Y. Grosdidier[1,2,3], *A. Acker*[1], *and A.F.J. Moffat*[2,3]

[1] Observatoire Astronomique de Strasbourg, UMR 7550, 11 rue de l'Université, F-67000 Strasbourg, France

[2] Université de Montréal, Département de Physique, C.P. 6128, Succursale Centre-Ville, Montréal (Québec) H3C 3J7, Canada

[3] Observatoire du mont Mégantic, Canada

Using spectroscopic observations taken at the Observatoire de Haute-Provence (France) and the Observatoire du mont Mégantic (Canada), we describe wind fluctuations in the [WC 8]-type central star of the planetary nebula NGC 40, HD 826, which was observed intensively during 22 nights. Moving features seen on the top of the CIIIλ5696 and CIV$\lambda\lambda$5801/12 (+CIIIλ5826) emission lines are interpreted as outflowing "blobs" which are radially accelerated outwards in the Wolf-Rayet wind. The amplitudes of the variations range up to 25–30% of the adjacent continuum flux, over timescales of hours. The variabilities of both lines are quite well correlated, although they are somewhat weaker for the CIV complex. Subpeaks (or gaps) on the top of the CIII line generally move towards the nearest line edge in a symmetric fashion in the blue and the red. Kinematic parameters of the blobs have been derived and compared to those observed for massive and other low-mass Wolf-Rayet stars. Especially impressive are the significantly larger observed maximum radial acceleration values of the blobs, compared to those already reported for massive WC 5–9, or low-mass [WC 9] stars. This is attributed to the very small stellar radius of HD 826. In addition the β velocity field is found to possibly underestimate the true gradient within the stellar wind flow. On the whole, the wind of HD 826 is highly stochastically variable on a very short time-scale. This supports a turbulent origin.

Accepted by A&A

Preprints can be obtained by contacting yves@ll.iac.es

Near-IR Observations of IRAS Sources with SiO Masers at the Inner Galactic Bulge

S. Deguchi[1], *T. Fujii*[2], *S. Matsumoto*[2], *J. Nakashima*[3], *P. Wood*[4]

[1]Nobeyama Radio Observatory, National Astronomical Observatory, Minamimaki, Minamisaku, Nagano 384-1305, Japan

[2] Department of Astronomy, The University of Tokyo, Bunkyo-ku, Tokyo 113-0032, Japan

[3]Department of Astronomical Science, The Graduate University for Advanced Studies, Nobeyama Radio Observatory, Minamimaki, Minamisaku, Nagano 384-1305, Japan

[4]Research School of Astronomy and Astrophysics, Australian National University, Cotter Road, Weston Creek ACT 2611, Australia

Near-infrared photometric observations in the J, H, and K bands have been made for 86 IRAS sources toward the inner Galactic bulge ($|l| < 3^\circ$ and $|b| < 3^\circ$). SiO maser emission has previously been detected in all of these sources; they are well-confirmed, mass-losing, late-type stars having accurate radial velocities derived from SiO observations. For 78 sources, single, unambiguous near-infrared counterparts were found within the errors of the IRAS positions; for the other 8 sources, multiple candidates, candidates with a low confidence level, or candidates overlapped with other stars were found. ¿From the J, H, K-band and IRAS 12 and 25 μm intensities, we estimated the spectral energy distributions of the sources, and obtained the distances, assuming a constant luminosity. The derived distances of the IRAS/SiO sources are consistent with the current bar model of the Galactic bulge, where the near side of the bar is located in the first quadrant of the galactic longitude. We also reanalyzed the radial velocity shift with distance, and confirmed the presence of streaming motions of stars in the bar-like bulge.

PASJ 2001 No.2 in press

Preprints can be obtained by contacting deguchi@nro.nao.ac.jp
or via WWW on http://www.nro.nao.ac.jp/~eiko/nroreport/
or via anonymous ftp on ftp://ftp.nro.nao.ac.jp/nroreport/No502.ps.gz

SiO Maser Survey of the Southern IRAS Sources

S. Deguchi[1], *J. Nakashima*[2], *R. Balasubramanyam,*[3]

Minamimaki, Minamisaku, Nagano 384-1305, Japan

[2]Department of Astronomical Science, The Graduate University for Advanced Studies, Nobeyama Radio Observatory, Minamimaki, Minamisaku, Nagano 384-1305, Japan

[3]School of Physics, University of New South Wales, Sydney, NSW 2052, Australia

We have surveyed 163 southern IRAS sources in the SiO J =2–1 v=1 maser line at 86 GHz, obtaining 38 (22 new and 16 previously known) detections. The detections include 6 stars not previously detecetd in OH 1612 MHz surveys and 4 sources assigned wrong OH radial velocities. The distance reachable in this survey turns out to be about 4 kpc. The local velocity dispersion near the Sun is found to be approximately 30 km s^{-1} for these IRAS/SiO sources. A relatively high concentration of the SiO detected sources are found at the area $320^\circ < l < 340^\circ$ (toward "Norma tangent"). The estimation of distances for these sources suggests that this concentration is spread between 2 and 6 kpc from the Sun, peaking on the Scutum-Crux arm.

PASJ 2001 No.2 in press

Preprints can be obtained by contacting deguchi@nro.nao.ac.jp
or via WWW on http://www.nro.nao.ac.jp/~eiko/nroreport/
or via anonymous ftp on ftp://ftp.nro.nao.ac.jp/nroreport/No504.ps.gz

Discovery of Extended X-ray Emission from the Planetary Nebula NGC7027 by the Chandra X-ray Observatory

Joel H. Kastner[1], *Saeqa Vrtilek*[2], *& Noam Soker*[3]

[1] Chester F. Carlson Center for Imaging Science, Rochester Institute of Technology, 54 Lomb Memorial Dr., Rochester, NY 14623 USA

[2] Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138

[3] Department of Physics, University of Haifa at Oranim, Oranim, Tivon 36006, ISRAEL

We report the discovery of X-ray emission from NGC 7027, a prototypical object for the study of the formation and evolution of planetary nebulae (PNs). Observations with the Advanced CCD Imaging Spectrometer (ACIS) aboard the Chandra X-ray Observatory show that the X-ray emission from NGC 7027 is extended and is bipolar

in morphology. The ACIS spectrum displays strong emission from highly ionized Ne and weaker emission features which we attribute to O, Mg, and Si. Model fits to this spectrum suggest a characteristic temperature $T_x \sim 3 \times 10^6$ K and an intrinsic (unabsorbed) X-ray luminosity of $L_x \sim 1.3 \times 10^{32}$ ergs s^{-1}. The intranebular absorption of X-ray emission is highly nonuniform, but the modeling indicates an average column density $N_H \sim 6 \times 10^{21}$ cm^{-2}, consistent with previous measurements of relatively large visual extinction within the nebula. We suggest that the X-ray emission from NGC 7027 is or was generated by a hitherto undetected fast wind from the central star of NGC 7027, or from a companion to this star. Chandra's detection of extended, high-temperature X-ray emission from BD +30° 3639, NGC 6543, and now NGC 7027 suggests that such emission is a common feature of young planetary nebulae.

Accepted by the Astrophysical Journal (Letters)

Preprints can be obtained by contacting jhk@cis.rit.edu
or via WWW on http://xxx.lanl.gov/archive/astro-ph (astro-ph/0102468)

Morphology and Galactic Distribution of PNe: a New Scenario

G. García-Segura, J. Franco, J. A. López, N. Langer and M. Różyczka

We review recent studies on the morphology and distribution with respect to the galactic plane of planetary nebulae (PNs), as well as recent advances in MHD modeling of PNs. We discuss a tentative explanation for the connection between morphological classes and their galactic distribution.

2001, RMxAASC, in press

Preprints can be obtained via WWW on http://arXiv.org/abs/astro-ph/0102044

Neutron-Capture Elements in Planetary Nebulae: Identification of Two Near-Infrared Emission Lines as [Kr III] and [Se IV]

H.L. Dinerstein[1]

[1] Astronomy Department & McDonald Observatory, University of Texas, Austin, TX 78712, U.S.A.

I propose that two previously unidentified lines at 2.199 and 2.287 μm seen in the spectra of planetary nebulae (PNe) are fine-structure transitions of Kr^{+2} and Se^{+3}. These are the cosmically most abundant elements with Z > 32. The ionic stages and originating energy levels of the observed transitions are expected to be significantly populated under nebular conditions, and these elements – especially the noble gas Kr – are unlikely to be strongly depleted out of the gas phase into grains. Furthermore, their concentrations can be enhanced by *s*-processing which occurs in the interiors of the PN progenitor stars. The observed line strengths are consistent with modest (factor of a few) overabundances. In support of the identification of the 2.199 μm line as [Kr III] $^3P_1$–$^3P_2$, PNe which display this line also show [Kr III] $^1D_2$–$^3P_2$ 6828 Å emission. I identify the 2.287 μm line as [Se IV] $^2P_{3/2}$–$^2P_{1/2}$. These identifications suggest a new range of possibilities for line identifications in the infrared. In addition, the observability of emission lines from *n*-capture species introduces a novel approach for studying advanced evolutionary stages and nucleosynthesis in the progenitor stars and for more fully delineating the role of PNe as agents of galactic chemical enrichment.

Accepted by Ap J Letters

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

Astronomer/Instrument Scientist - SAAO

The South African Astronomical Observatory (SAAO) seeks an astronomer with a strong interest in infrared/optical instrumentation.

The SAAO is the National Facility for optical/infrared astronomy in South Africa. Its headquarters are in Cape Town where the successful applicant will be based. Observing facilities, situated 360 km away at Sutherland, comprise four common-user telescopes and a recently commissioned 1.4-m Infrared Survey Facility (IRSF) run in collaboration with Nagoya University, Japan. Construction of the Southern African Large Telescope (SALT), a 10-m class instrument, should be completed by 2004.

The preferred applicant will have experience in working with near-infrared and/or optical CCD arrays. A PhD in astrophysics or a related subject is essential as she/he will also be expected to spend about 50% of their time on research. More details of SAAO, SALT and the current research interests of their staff are available at www.saao.ac.za and www.salt.ac.za.

Applicants should submit a curriculum vitae, with a statement of research and instrumentation interests to: The Personnel Officer, Ms Linda Tobin, SAAO, P O Box 9, Observatory, 7935, South Africa, phone: +27 21 4470025; fax: +27 21 4473639; email: linda@saao.ac.za. Applicants should also arrange for three professional referees to supply letters of recommendation to the same address by the due date of 1 April 2001.

SAAO is committed to equity.

Astronomical Research Fellow - SAAO

Applications are invited for a postdoctoral research fellowship at the South African Astronomical Observatory (SAAO). The appointment will be for two years, with a likely extension to a third year. Preference will be given to candidates with an interest in infrared and/or optical instrumentation.

The SAAO is the National Facility for optical/infrared astronomy in South Africa. Its headquarters are in Cape Town where the successful applicant will be based. Observing facilities, situated 360 km away at Sutherland, comprise four common user telescopes and a recently commissioned 1.4-m Infrared Survey Facility (IRSF) run in collaboration with Nagoya University, Japan. Construction of the Southern African Large Telescope (SALT), a 10-m class instrument, should be completed by 2004.

While the successful applicant will spend most of their time on research, they will also be encouraged to contribute to the SAAO's instrumentation or software development programmes as well as supporting visiting astronomers. More details of the SAAO, SALT and the current research interests of their staff are available at www.saao.ac.za and www.salt.ac.za.

Applicants must have a PhD in astrophysics or a related subject. They should submit a curriculum vitae, with a statement of research and instrumentation interests to: The Personnel Officer, Ms Linda Tobin, SAAO, P O Box 9, Observatory, 7935, South Africa, phone: +27 21 4470025; fax: +27 21 4473639; email: linda@saao.ac.za. Applicants should also arrange for three professional referees to supply letters of recommendation to the same address by the due date of 1 April 2001.

SAAO is committed to equity.

Research Studentship - University of Hertfordshire
Postgraduate research in AGB/post-AGB stars

Applications are invited for a University Research Studentship within the Department of Physical Sciences. The studentship will begin in October 2001 and is tenable for up to 3 years. There is an annual stipend of 7850 UK Pounds. Applications will be considered in competition with those in other areas of astrophysics and physics research and applicants should have or expect to obtain a good degree in a relevant discipline.

The AGB and post-AGB research programme is concerned with understanding the development and evolution of outflows, the onset of asymmetry and the formation of proto-planetary and planetary nebulae. The group obtains substantial amounts of observing time on ground based 4m and 8m telescopes, including near and mid-infrared imaging polarimetry, and on UK and European radio facilities. It is currently supported by two staff, a post-doctoral researcher and a graduate student.

Informal enquiries may be made to Dr Tim Gledhill (tmg@star.herts.ac.uk) or Dr Jeremy Yates (jyates@star.herts.ac.uk).

How to apply: Send a signed letter of application, your CV and the names and contact details of two academic referees to Dr Andy Robinson at the address below.

The closing date for applications is 31 March 2001

Dr A. Robinson
Postgraduate Admissions Tutor
Department of Physical Sciences
University of Hertfordshire
Hatfield
Herts AL10 9AB
E-mail : ar@star.herts.ac.uk
Tel: 01707 286072
Fax: 01707 284644

Postdoctoral Fellowship in Stellar Oscillations

School of Physics
University of Sydney
Australia

REF NO: A06/001263
Closing Date: 15/3/2001

Applications are invited for a postdoctoral fellow to work with Dr Tim Bedding on stellar oscillations. The project is to detect and interpret oscillations in solar-like stars using ground-based telescopes and to participate in the development of the Danish-led space telescope MONS (Measuring Oscillations in Nearby Stars).

Candidates must possess a PhD in astronomy or equivalent, show proven research ability, evidence of the potential for further development and evidence of ability to work co-operatively with others. Experience in developing and using software for reduction of astronomical data is essential.

Experience in stellar spectroscopy and/or photometry, particularly observations and analysis of stellar oscillations, is desirable, as are familiarity with IDL and expertise in time series analysis using Fourier transforms and related methods.

The position is full-time fixed term for one year, subject to the completion of a probation period for new appointees. There is the possibility of further offers of employment up to 1.5 years, subject to funding and need.

Applicants are encouraged to contact Dr Tim Bedding on (02) 9351 2680, fax (02) 9351 7726 or e-mail: bedding@physics.usyd.edu.au before applying.

Remuneration Package: 42,567−57,767 p.a. (which includes a base salary Level A 35,970−48,814 p.a., leave loading and up to 17% employer's contribution to superannuation)

Applications (five copies) should quote the reference no. (A06/001263), address the selection criteria, and include a CV, a list of publications, and the names, addresses, e-mail, fax and phone number of three confidential referees. They should be sent to:

The Personnel Officer
College of Sciences and Technology
Carslaw Building (F07)
The University of Sydney, NSW, 2006
AUSTRALIA

Closing Date: 15/3/2001

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