THE MAGELLANIC CLOUDS NEWSLETTER
An electronic exchange on Magellanic Clouds research

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No. 53 March 19, 2001

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Abstracts of Refereed Papers

On the Second Overtone Stability among SMC Cepheids

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We present a new set of Cepheid, full amplitude, nonlinear, convective models which are pulsationally unstable in the second overtone (SO). Hydrodynamical models were constructed by adopting a chemical composition typical for Cepheids in the Small Magellanic Cloud (SMC) and stellar masses ranging from 3.25 to 4 solar masses. Predicted ϕ₂₁ Fourier parameters agree, within current uncertainties, with empirical data for pure first and second overtone variables as well as for first/second overtone (FO/SO) double-mode Cepheids collected by Udalski et al. (1999a,b) in the SMC. On the other hand, predicted I band amplitudes are systematically larger than the observed ones in the short period range. We also find, in agreement with empirical evidence, that the region within which both second and first overtones attain a stable limit cycle widens when moving toward lower luminosities. Moreover, predicted PSO/PFO and PFO/PF period ratios agree quite well with empirical period ratios for FO/SO and F/FO double-mode SMC Cepheids. Finally, current models support the evidence that pure SO Cepheids and SO components in FO/SO Cepheids are good distance indicators.

Accepted by: MNRAS
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Also available from the URL http://xxx.lanl.gov/abs/astro-ph/0103107
Stellar Luminosity Functions of Rich Star Clusters in the Large Magellanic Cloud

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We show the results of deep V and J HST photometry of 6 rich star clusters in the Large Magellanic Cloud with different ages and metallicities. The number of stars with measured magnitudes in each cluster varies from about 3000 to 10000 stars. We build stellar density and surface brightness profiles for the clusters and extract half-light radii and other structural parameters for each. We also obtain luminosity functions, $\Phi(M_V)$, down to $M_V \simeq 6$ ($M/M_\odot \gtrsim 0.9$), and investigate their dependence with distance from the cluster centre well beyond their half-light radius. In all clusters we find a systematic increase in the luminosity functions slope, $\Delta \log \Phi(M_V) / \Delta (M_V)$, with radial distance from the centre. Among the clusters displaying significant mass segregation are the 2 youngest in the sample: NGC 1805, NGC 1818. For these two clusters we obtain present day mass functions. The NGC 1818 mass function is in excellent agreement with that derived by other authors, also using HST data. The young cluster mass function slopes differ, that of NGC 1805 being systematically steeper than NGC 1818. Since these are very young stellar systems ($\tau \lesssim 40$ Myrs), these variations may reflect the initial conditions rather than evolution due to internal dynamics.

Accepted by: Astronomy & Astrophysics
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Also available from the URL http://xxx.lanl.gov/abs/astro-ph/0102369

Discovery of Pulsations from the Be/X-ray Binary RX J0101.3–7211 in the SMC by XMM-Newton

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We report pulsations in the X-ray flux of RX J0101.3–7211 in the Small Magellanic Cloud (SMC) with a period of $$(455 \pm 2)$$ s in XMM-Newton EPIC-PN data. The X-ray spectrum can be described by a power-law with a photon index of $0.6 \pm 0.1$. Timing analysis of ROSAT PSPC and HRI archival data confirms the pulsations and indicates a period increase of $\sim 5$ s since 1993. RX J0101.3–7211 varied in brightness during the ROSAT observations with timescales of years with a maximum unabsorbed flux of $6 \times 10^{-13}$ erg cm$^{-2}$ s$^{-1}$ (0.1 – 2.4 keV). The flux during the XMM-Newton observation in the ROSAT band was lower than during the faintest ROSAT detection. The unabsorbed luminosity derived from the EPIC-PN spectrum is $2 \times 10^{35}$ erg s$^{-1}$ (0.2 – 10.0 keV) assuming a distance of 60 kpc. Optical spectra of the proposed counterpart taken at the 2.3 m telescope of MSSSO in Australia in August 2000 show strong H$\alpha$ emission and indicate a Be star. The X-ray and optical data confirm RX J0101.3–7211 as a Be/X-ray binary pulsar in the SMC.

Accepted by: Astronomy & Astrophysics Letters
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ASCA Identification of SMC X-2 with the 2.37-s Pulsar Discovered by RXTE

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ASCA observed a new X-ray pulsar recently discovered with RXTE in the Small Magellanic Cloud, and detected coherent pulsations with a barycentric period of 2.37230 ± 0.00004 s. The position is determined within a ∼ 30" radius error, which is much more accurate than that reported with RXTE. Since the position error well overlaps to a ∼ 20" radius error of the SAS-3 transient source SMC X-2, and since the probability that an unrelated source falls in the error region by chance is estimated to be less than 0.1%, we conclude that SMC X-2 is the 2.37-s pulsar. The X-ray spectrum in the 0.7–10.0 keV band can be fitted with a model of a power-law continuum plus a fluorescent line from neutral or low-ionization iron. The pulse profile has a single peak below a few keV and gradually changes to be a double-peaked structure as the energy increases; in particular, the iron line band (6.0–7.0 keV) marginally shows a double-peaked profile similar to that of the higher energy band observed with RXTE.

Accepted by: PASJ

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Also available from the URL \texttt{http://www-cr.scphys.kyoto-u.ac.jp/member/jun/job/}
\texttt{http://xxx.lanl.gov/abs/astro-ph/0102459}
Abstracts of Non-Refereed Papers

Young Supernova Remnants in the Magellanic Clouds

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There are a half-dozen or so young supernova remnants in the Magellanic Clouds that display one or more of the following characteristics: high velocity ($\gtrsim 1000$ km s$^{-1}$) emission, enhanced metallicity, or a rapidly rotating pulsar. I summarize the current state of knowledge of these remnants and present some recent results mostly from the new X-ray astronomy satellites.


For preprints, contact jph@physics.rutgers.edu
Also available from the URL http://xxx.lanl.gov/abs/astro-ph/0102377

Magellanic Clouds Planetary Nebulae: an updated view on stellar evolution and populations

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Planetary Nebulae (PNs) in the Magellanic Clouds are studied to understand stellar populations and evolution of low- and intermediate-mass stars in different chemical environments. Using HST observations from our LMC and SMC PN morphological survey and from the HST Data Archive, we look at the relations between PN morphology and their evolution and populations. In this paper we show some of our recent results on these relations, in an historical context.


For preprints, contact lstanghe@stsci.edu
Also available from the URL http://xxx.lanl.gov/abs/astro-ph/0103076
Job Opportunity

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.

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