The Magellanic Clouds Newsletter
An electronic exchange of Magellanic Clouds information

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News and Views
IAU Symposium on the Magellanic Clouds

As announced in the last MC Newsletter, an IAU Symposium on the Magellanic Clouds is being planned. We are pleased with the responses from the community, and we thank those who have volunteered to help. A Scientific Organization Committee representing a diversity of disciplines and countries is being assembled. A formal proposal for the symposium will be forthcoming soon. Suggestions on the topics and format of the program are still welcome. Updates on the preparation will be posted in the World-Wide Web page at http://www.astro.uiuc.edu/mcnews/MC_IAUsymp.html and at http://www.astro.uni-wuerzburg.de/~grebel/MC_IAUsymp.html.
Please send comments and suggestions to mcnews@astro.uiuc.edu. Thank you.

The Magellanic Clouds Newsletter on the World-Wide Web

The Magellanic Clouds Newsletter has been available on the world-wide web for some time now (URLs see above). The present and past issues of the Newsletter can be downloaded either as \TeX files or as postscript files. The \TeX template is available as well. We update the compilation of meetings of potential interest for Magellanic Clouds researchers twice a month. A special web page is dedicated to a proposed IAU Symposium on the Magellanic Clouds (see above). Job advertisements of positions related to the Magellanic Clouds are posted as soon as we receive them. We provide links to other web sites related to Magellanic Clouds research and additional links of interest such as other newsletters, ground-based southern observatories, and space observatories. If you have suggestions for improvements, please let us know.
Abstracts of Refereed Papers

The Evolution of Ultraviolet Emission Lines From Circumstellar Material Surrounding SN 1987A

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The presence of narrow high-temperature emission lines from nitrogen-rich gas close to SN 1987A has been a principal observational constraint on the evolutionary status of the supernova’s progenitor. A new analysis of the complete five-year set of low and high resolution IUE ultraviolet spectra of SN 1987A (1987.2–1992.3) provide fluxes for the N V 1240, N IV] 1486, He II 1640, O III] 1665, N III] 1751, and C III] 1908 lines with significantly reduced random and systematic errors and reveals significant short-term fluctuations in the light curves. The N V, N IV], and N III] lines turn on sequentially over 15 to 20 days and show a progression from high to low ionization potential, implying an ionization gradient in the emitting region. The line emission turns on suddenly at 83 ± 4 days after the explosion, as defined by N IV]. The N III] line reaches peak luminosity at 399 ± 15 days. A ring radius of (6.24 ± 0.20) × 10\textsuperscript{17} cm and inclination of 41.0 ± 3.9 degrees is derived from these times, assuming a circular ring. The probable role of resonant scattering in the N V light curve introduces systematic errors that leads us to exclude this line from the timing analysis. A new nebular analysis yields improved CNO abundance ratios of N/C = 6.1 ± 1.1 and N/O = 1.7 ± 0.5, confirming the nitrogen enrichment found in our previous paper. From the late-time behavior of the light curves we find that the emission originates from progressively lower density gas and that the emitting region has a multi-component density structure. We estimate the emitting mass near maximum (≈ 400 days) to be ∼ 0.047 solar masses, assuming a filling factor of unity and an electron density of 2.6 × 10\textsuperscript{4} cm\textsuperscript{-3}. These results are discussed in the context of current models for the emission and hydrodynamics of the ring.

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High velocity motions inside the H\text{II} region N103 of the Large Magellanic Cloud

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The gas of the H\text{II} region N103 of the Large Magellanic Clouds surrounds the double cluster NGC 1850.
We have observed the HII region with a scanning Fabry-Perot interferometer at Hα and [OIII]5007 wavelengths. The kinematics of this field show high velocity motions. We discuss their origin: Supernova explosion or particularly strong stellar winds.

By calculating the energy input inside the gas, we show that it is unlikely that the high velocity motions are due to the stellar winds of the embedded stars. The required number of O stars is too high for the known stellar content, and the extremely faint [OIII]5007 emission gives a strong limit to the number of stars hotter than 37000 K. The model of an old Supernova explosion agrees better to the energetic balance, if it occurred inside a cavity already driven by the stellar winds. Since the extrapolation of the IMF of the cluster leads to think that at least three massive stars have already exploded, such an assumption is the most plausible.

Then the nebula N103 is linked to two supernova remnants of different ages. The oldest one can be represented by a bubble, 152 pc wide, seen projected against the HII region, and probably lying at the edge of the HII region. The exciting stars of the nebula are actually members of the LMC cluster NGC 1850B; they provide a photon flux large enough to ionize the quiet part of the gas.

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Ultraviolet Imaging Telescope Observations of OB Stars in the N11 Region of the LMC

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We present an analysis of far-ultraviolet (FUV: 1300-1800 Å) and optical (U, B, and V) data of the stellar and nebular content of the OB associations LH9, 10, and 13 in the Large Magellanic Cloud region N11. The FUV images from The Ultraviolet Imaging Telescope strongly select the hot O and B stars; over 1900 stars were detected in the FUV to a limiting magnitude of m132 = 17 mag. The resulting FUV photometry combined with optical ground-based data indicate there are approximately 88 confirmed or candidate O stars in the LH9, 10, and 13 fields alone (in an area of ~ 41 arcmin2), and possibly as many as 170 to 240 O-type stars within the entire 40 arcmin-diameter field of view.

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For preprints, contact joel@hasta.space.swri.edu
Also available by anonymous ftp at k2.space.swri.edu/pub/uit_n11.ps
or from the URL http://k2.space.swri.edu/papers/papers.html
An H\textsc{i} Aperture Synthesis Mosaic of the Small Magellanic Cloud

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We present the results of a survey of neutral hydrogen emission in the Small Magellanic Cloud (SMC) with the Australia Telescope Compact Array (ATCA). The survey consists of a mosaic of 320 separate pointings of the 375-m array, resulting in a resolution of 1.6 arcmin (28 pc, for a distance of 60 kpc) over a field of 20 deg\textsuperscript{2}. The rms brightness temperature sensitivity is 1.4 K, corresponding to an H\textsc{i} column-density sensitivity of $4 \times 10^{18}$ cm\textsuperscript{-2} for each velocity channel of width 1.6 kms\textsuperscript{-1}. The H\textsc{i} distribution is complex and, on scales < 1 kpc, appears to be dominated by the effects of expanding H\textsc{i} shells, which are probably driven by the combined effects of supernovae and stellar winds from massive stars. The picture of the SMC that arises from the current data seems to challenge the earlier belief that the SMC consists of two or more spatially separate structures with different systemic velocities. We find that the observed multiple components are, in many cases, caused by the combined effects of the numerous shells and supershells. Altogether, we identify six supershells (defined here as those with radii greater than 300 pc) and 495 giant shells. For each of these, we measure positions, radii, velocities and expansion rates, and derive ages and kinetic energy requirements. The apparent age distribution of shells is remarkably narrow, with a mean age of 5.4 Myr and an intrinsic dispersion of 2 Myr. Southern shells appear to be older, on average, by 2.5 Myr. The kinetic energy of the shells is a large fraction of the gravitational binding energy of the SMC, implying that further disintegration of the SMC will occur with time, and especially at the next close passage with the LMC or the Galaxy, unless the SMC possesses a massive halo. Because of their interferometric nature, the images presented here are insensitive to structures of size > 0.6\textdegree, and should not be used for deriving total H\textsc{i} column densities.

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For preprints, contact lstavele@atnf.csiro.au
Also available by anonymous ftp at ftp://ftp.atnf.csiro.au/pub/data/smc/
or from the URL http://www.atnf.csiro.au/~lstavele

Ring nebula and bipolar outflows associated with the B1.5 supergiant Sher #25 in NGC 3603

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We have identified a ring-shaped emission-line nebula and a possible bipolar outflow centered on the B1.5 supergiant Sher #25 in the Galactic giant H\textsc{i} region NGC 3603 (distance 6 kpc). The clumpy ring around Sher #25 appears to be tilted by 64\textdegree against the plane of the sky. Its semi-major axis (position angle $\approx 165^\circ$) is 6.9\arcsec long, which corresponds to a ring diameter of 0.4 pc. The bipolar outflow filaments, presumably located above and below the ring plane on either side of Sher #25, show a separation of $\approx 0.5$ pc from the central star.

High-resolution spectra show that the ring has a systemic velocity of $V_{\text{LSR}} = +19$ km s\textsuperscript{-1} and a de-projected expansion velocity of 20 km s\textsuperscript{-1}, and that one of the bipolar filaments has an outflow
speed of $\sim 83$ km s$^{-1}$. The spectra also show high [NII]/H$\alpha$ ratio, suggestive of strong N enrichment. Sher #25 must be an evolved blue supergiant (BSG) past the red supergiant (RSG) stage. We find that the ratio of equatorial to polar mass-loss rate during the red supergiant phase was $\approx 16$. We discuss the results in the framework of RSG–BSG wind evolutionary models.

We compare Sher #25 to the progenitor of SN 1987A, which it resembles in many aspects.

Submitted to: Astrophysical Journal Letters
For preprints, contact brandner@astro.uni-wuerzburg.de
Also available from the URL http://www.astro.uni-wuerzburg.de/supplements.html

Abstracts of Non-Refereed Papers

A photometric study of NGC 458

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We present a CCD investigation of the poorly known young SMC globular cluster NGC 458. The NTT data presented here allowed us to study in detail the more internal regions of the cluster which are less contaminated by the field. On the basis of theoretical isochrones, a preliminary evaluation of the age is also given.

For preprints, contact vincenzo@astr1pi.difi.unipi.it
Master Thesis Abstract

Age Determination For Two Globular Clusters in the Small Magellanic Cloud

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I analyzed $B, V$ CCD photometry of the two globular clusters NGC 419 and NGC 416 in the eastern wing of the Small Magellanic Cloud (SMC). CCD photometry for both clusters was obtained with the 1.52 Danish telescope at ESO, La Silla. For NGC 416 I also used archival WFPC2 HST data. The ages of the clusters, of the surrounding field, and of an additional field in the wing of the SMC were determined by fitting isochrones from the Padua group (e.g., Bertelli et al. 1994, A&AS, 106, 275) to the colour-magnitude diagrams (CMDs). The CMDs show strong field star contamination. I therefore developed a program for statistical field star subtraction.

- For the cluster NGC 419 I derived an age of 1.3 ± 0.5 Gyr and a reddening of $E_{B-V} = 0.03$ mag with $(m - M)_0 = 18.9$ mag.

- At least two pronounced young field populations could be discerned around NGC 419. The youngest field star population has an age of 12 to 50 Myr and a reddening of $E_{B-V} = 0.01$ mag. The second field population is somewhat older (130 ± 30 Myr) and more strongly reddened ($E_{B-V} = 0.06$ mag), suggesting that it might be located behind the younger one. Isochrones with a metallicity of $Z = 0.008$ fitted both field star populations best.

- For NGC 416 best fits were obtained for an age of 2.6 ± 0.6 Gyr and $E_{B-V} = 0.1$ to 0.15 mag with $(m - M)_0 = 18.6$ mag.

- Three young populations could be distinguished in the field in which NGC 416 is embedded: 8 ± 2 Myr, 50 ± 13 Myr, and 160 ± 30 Myr, all with $E_{B-V} = 0.1$ mag.

- For the field in the wing I detected three different populations, two of which have ages similar to the ones derived from the field surrounding the clusters: 25 ± 6 Myr, $E_{B-V} = 0.13$ mag 130 ± 30 Myr, $E_{B-V} = 0.15$ mag 2 ± 0.5 Gyr, $E_{B-V} = 0.1$ mag.


Since the HST data go down to fainter magnitudes than the ground-based data, and since they show a well-defined main-sequence turn-off for NGC 416, they allowed me to carry out a more accurate age determination. Based on the HST data I find an age of 6.3 ± 1.6 Gyr for a best-fitting isochrone with a reddening of $E_{B-V} = 0.08 ± 0.01$.

Diploma Thesis work carried out at the University of Bonn under direction of Prof. Klaas S. de Boer and Prof. Ulrich Mebold. Completed 1996 May.
For preprints of forthcoming papers, contact adieball@astro.uni-bonn.de.
Job Advertisement

Postdoctoral Fellowship
of the German Research Foundation at Bochum University

The Astronomical Institutes of the Universities of Bonn and Bochum are carrying out a joint research program on “The Magellanic Clouds and Other Dwarf Galaxies”. This project is financed by the German Research Foundation and comprises fellowships for PhD students and postdoctoral fellowships. Faculty members at the two universities involved in this project are Prof. K.S. de Boer, Prof. R.-J. Dettmar, Prof. J.V. Feitzinger, Dr. R. Hanuschik, Prof. U. Klein, Prof. U. Mebold, Dr. T. Richter, Prof. W. Seggewiss, and Prof. Th. Schmidt-Kaler. For more information on the research project, see http://aibn55.astro.uni-bonn.de:8000/~software/Dwarfs_group.html and http://www.astro.ruhr-unibochum.de/kam/grad.html.

A new postdoctoral fellowship within the framework of this research project at the Astronomical Institute of Bochum University will be available starting January 1, 1997. In accordance with remunerations of fellowships of the German Research Foundation, the tax-free salary for this position is DM 2400 (plus DM 300 for married postdocs).

Applications are invited from candidates with experience in structure and evolution of galaxies or in the physics of the interstellar medium. Please send your application documents and any inquiries to the speaker of the research group, Prof. U. Klein (e-mail: uklein@astro.uni-bonn.de; postal address: Radioastronomisches Institut der Universität Bonn, Auf dem Hügel 71, D-53121 Bonn, Germany). The deadline for applications has been extended to October 31, 1996.

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free of charge as soon as they become available.