Dear Colleagues,

It is our pleasure to present the 82nd issue of the Magellanic Clouds Newsletter. Many thanks for your contributions, which are very interesting and diverse. These include several papers based on Spitzer Space Telescope data: the SAGE survey, abundant molecules in carbon stars (two contributions), dust and gas in planetary nebulae, and the elusiveness of dust in supernova remnants. There are also several contributions on massive early-type stars, the Magellanic Cloud System, et cetera. Don’t miss the job advert for positions at Armagh Observatory.

This month the Magellanic Clouds are certain to feature prominently at two major conferences: IAU Symposium 237 (Triggered Star Formation in a Turbulent ISM) in Prague, and "Why Galaxies Care About AGB Stars" in Vienna during the preceding week.

The next issue will be distributed on the 1st of October; the deadline for contributions is the 30th of September.

Editorially Yours,
Jacco van Loon and Snežana Staničević
The Chandra View of the Supernova Remnant 0506–68.0 in the Large Magellanic Cloud

John P. Hughes¹, Marc Rafelski², Jessica S. Warren¹, Cara Rakowski³, Patrick Slane³, David Burrows⁴ and John Nousek⁴

¹Rutgers University, USA
²UCLA, USA
³Harvard-Smithsonian CfA, USA
⁴Penn State, USA

A new Chandra observation of SNR 0506–68.0 (also called N23) reveals a complex, highly structured morphology in the low energy X-ray band and an isolated compact central object in the high energy band. Spectral analysis indicates that the X-ray emission overall is dominated by thermal gas whose composition is consistent with swept-up ambient material. There is a strong gradient in ambient density across the diameter of the remnant. Toward the southeast, near a prominent star cluster, the emitting density is \(10^{-23}\) cm\(^{-3}\) while toward the northwest it has dropped to a value of only 1 cm\(^{-3}\). The total extent of the X-ray remnant is 100" by 120" (24 pc \(\times\) 29 pc for a distance of 50 kpc), somewhat larger than previously known. The remnant’s age is estimated to be \(\sim 4600\) yr. One part of the remnant shows evidence for enhanced O, Ne, and perhaps Mg abundances, which is interpreted as evidence for ejecta from a massive star core collapse supernova. The compact central object has a luminosity of a few times \(10^{33}\) ergs/s and no obvious radio or optical counterpart. It does not show an extended nebula or pulsed emission as expected from a young energetic pulsar, but resembles the compact central objects seen in other core collapse SNe, such as Cas A.

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Spitzer observations of acetylene bands in carbon-rich AGB stars in the Large Magellanic Cloud


¹University of Manchester, UK
²QUB, UK
³NAOJ, Japan
⁴ANU, Australia
⁵Cornell University, USA
⁶Keele University, UK
⁷KU Leuven, Belgium
⁸University of Edinburgh, UK
⁹University of Cape Town, South Africa
¹⁰Sterrewacht Leiden, The Netherlands
¹¹Institut d’Astrophysique de Paris, France
¹²South African Astronomical Observatory, South Africa
¹³Astronomical Institute “Anton Pannekoek”, University of Amsterdam, The Netherlands
¹⁴University of Cape Town, South Africa

We investigate the molecular bands in carbon-rich AGB stars in the Large Magellanic Cloud (LMC), using the InfraRed Spectrograph (IRS) on board the Spitzer Space Telescope (SST) over the 5–38 µm range. All 26 low-resolution spectra
show acetylene (C$_2$H$_2$) bands at 7 and 14 $\mu$m. The hydrogen cyanide (HCN) bands at these wavelengths are very weak or absent. This is consistent with low nitrogen abundances in the LMC. The observed 14 $\mu$m C$_2$H$_2$ band is reasonably reproduced by an excitation temperature of 500 K. There is no clear dilution of the 14 $\mu$m band by circumstellar dust emission. This 14 $\mu$m band originates from molecular gas in the circumstellar envelope in these high mass-loss rate stars, in agreement with previous findings for Galactic stars. The C$_2$H$_2$ column density, derived from the 13.7 $\mu$m band, shows a gas mass-loss rate in the range $3 \times 10^{-6}$ to $5 \times 10^{-5}$ M$_{\odot}$ yr$^{-1}$. This is comparable with the total mass-loss rate of these stars estimated from the spectral energy distribution. Additionally, we compare the line strengths of the 13.7 $\mu$m C$_2$H$_2$ band of our LMC sample with those of a Galactic sample. Despite the low metallicity of the LMC, there is no clear difference in the C$_2$H$_2$ abundance among LMC and Galactic stars. This reflects the effect of the 3rd dredge-up bringing self-produced carbon to the surface, leading to high C/O ratios at low metallicity.

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C. J. Evans$^1$, D. J. Lennon$^2$, S. J. Smartt$^3$ and C. Trundle$^3$

$^1$UK Astronomy Technology Centre, Edinburgh, Scotland
$^2$Isaac Newton Group of Telescopes, La Palma, Spain
$^3$Queen’s University of Belfast, Northern Ireland

We present new observations of 470 stars using the Fibre Large Array Multi-Element Spectrograph (FLAMES) instrument in fields centered on the clusters NGC 330 and NGC 346 in the Small Magellanic Cloud (SMC), and NGC 2004 and the N11 region in the Large Magellanic Cloud (LMC). A further 14 stars were observed in the N11 and NGC 330 fields using the Ultraviolet and Visual Echelle Spectrograph (UVES) for a separate programme. Spectral classifications and stellar radial velocities are given for each target, with careful attention to checks for binarity. In particular we have investigated previously unexplored regions around the central LH9/LH10 complex of N11, finding ~25 new O-type stars from our spectroscopy. We have observed a relatively large number of Be-type stars that display permitted Fe$^{II}$ emission lines. These are primarily not in the cluster cores and appear to be associated with classical Be-type stars, rather than pre main-sequence objects. The presence of the Fe$^{II}$ emission, as compared to the equivalent width of H$\alpha$, is not obviously dependent on metallicity. We have also explored the relative fraction of Be- to normal B-type stars in the field-regions near to NGC 330 and NGC 2004, finding no strong evidence of a trend with metallicity when compared to Galactic results. A consequence of service observations is that we have reasonable time-sampling in three of our FLAMES fields. We find lower limits to the binary fraction of O- and early B-type stars of 23 to 36%. One of our targets (NGC346-013) is especially interesting with a massive, apparently hotter, less luminous secondary component.

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The VLT-FLAMES survey of massive stars: Mass loss and rotation of early-type stars in the SMC

M.R. Mokiem$^1$, A. de Koter$^1$, C.J. Evans$^2$, J. Puls$^3$, S.J. Smartt$^4$, P.A. Crowther$^5$, A. Herrero$^6$$^7$, N. Langer$^8$, D.J. Lennon$^9$$^6$, F. Najarro$^{10}$, M.R. Villamariz$^{11,6}$ and S.-C. Yoon$^1$

$^1$Astronomical Institute Anton Pannekoek, University of Amsterdam, The Netherlands
$^2$UK Astronomy Technology Centre, Royal Observatory, Scotland
$^3$Universittäts-Sternwarte München, Germany
$^4$The Department of Pure and Applied Physics, The Queen’s University of Belfast, Northern Ireland
$^5$Department of Physics and Astronomy, University of Sheffield, England
$^6$Instituto de Astrofísica de Canarias, Spain
$^7$Departamento de Astrofísica, Universidad de La Laguna, Spain
$^8$Astronomical Institute, Utrecht University, The Netherlands
$^9$The Isaac Newton Group of Telescopes, Spain
$^{10}$Instituto de Estructura de la Materia, Consejo Superior de Investigaciones Científicas, CSIC, Spain
$^{11}$Gratecan S.A., Spain

We have studied the optical spectra of a sample of 31 O- and early B-type stars in the Small Magellanic Cloud, 21 of which are associated with the young massive cluster NGC 346. Stellar parameters are determined using an automated fitting method (Mokiem et al. 2005), which combines the stellar atmosphere code FASTWIND (Puls et al. 2005) with the genetic algorithm based optimisation routine PIKAIA (Charbonneau 1995). Comparison with predictions of stellar evolution that account for stellar rotation does not result in a unique age, though most stars are best represented by an age of 1–3 Myr. The automated method allows for a detailed determination of the projected rotational velocities. The present day $v_{\sin i}$ distribution of the 21 dwarf stars in our sample is consistent with an underlying rotational velocity ($v_r$) distribution that can be characterised by a mean velocity of about 160–190 km s$^{-1}$ and an effective half width of 100–150 km s$^{-1}$. The $v_r$ distribution must include a small percentage of slowly rotating stars. If predictions of the time evolution of the equatorial velocity for massive stars within the environment of the SMC are correct (Maeder & Meynet 2001), the young age of the cluster implies that this underlying distribution is representative for the initial rotational velocity distribution. The location in the Hertzsprung-Russell diagram of the stars showing helium enrichment is in qualitative agreement with evolutionary tracks accounting for rotation, but not for those ignoring $v_r$. The mass loss rates of the SMC objects having luminosities of $\log L/L_\odot > 5.4$ are in excellent agreement with predictions by Vink, de Koter & Lamers (2001). However, for lower luminosity stars the winds are too weak to determine $\dot{M}$ accurately from the optical spectrum. Two of three spectroscopically classified Vz stars from our sample are located close to the theoretical zero age main sequence, as expected. Three additional objects of lower luminosity, which are not given this classification, are also found to lie near the ZAMS. We argue that this is related to a temperature effect inhibiting relatively cool stars from displaying the spectral features characteristic for the Vz luminosity class.

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Magellanic Stream in MOND

Hossein Haghi$^1$, Sohrab Rahvar$^{1,2}$ and Akram Hasani-Zonooz$^3$

$^1$Department of Physics, Sharif University of Technology, P.O.Box 11365–9161, Tehran, Iran
$^2$Institute for Studies in Theoretical Physics and Mathematics, P.O.Box 19395–5531, Tehran, Iran
$^3$Department of Physics, Azarbaijan University of Tarbiat Moallem, Azarshahr, Tabriz, Iran

The dynamics of Magellanic Stream (MS) as a series of clouds extended from the Magellanic Clouds (MCs) to the south Galactic pole is affected by the distribution and the amount of matter in the Milky Way (MW). We calculate the gravitational effect of the Galactic disk on MS in the MOdified Newtonian Dynamics (MOND) frame work and compare with the observations of the radial velocity. We compare these results with that in the logarithmic and power-law dark halo models and show that the MOND theory seems plausible for describing the dynamics of satellite galaxies as MCs. A maximum likelihood analysis is used to obtain the best parameters of the MOND and the Galactic disk.
On the other hand the gradient of column density on MS is modeled for a comoving observer using the MONDian hydrodynamical equilibrium of the gas and the gravitational force of MCs. We show that the observed profile of column density in MS is almost compatible with the model but the mass of the MCs results from this comparison is one order of magnitude less than our expectation. This result could be due to the dependence of the MONDian acceleration scale to the physical parameters of the system such as the size of the structure or in another word the non-universality of the acceleration scale of the MOND.

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On the Metallicity Dependence of HMXBs

Lynnette M. Dray

1University of Leicester, UK

It is commonly assumed that high mass X-ray binary (HMXB) populations are little-affected by metallicity. However, the massive stars making up their progenitor systems depend on metallicity in a number of ways, not least through their winds. We present simulations, well-matched to the observed sample of Galactic HMXBs, which demonstrate that both the number and the mean period of HMXB progenitors can vary with metallicity, with the number increasing by about a factor of three between solar and SMC metallicity. However, the SMC population itself cannot be explained simply by metallicity effects; it requires both that the HMXBs observed therein primarily sample the older end of the HMXB population, and that the star formation rate at the time of their formation was very large.

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Is the SMC Bound to the LMC? The HST Proper Motion of the SMC

Nitya Kallivayalil1, Roeland P. van der Marel2 and Charles Alcock1

1Harvard-Smithsonian Center for Astrophysics, USA
2Space Telescope Science Institute, USA

We present a measurement of the systemic proper motion of the Small Magellanic Cloud (SMC) made using the Advanced Camera for Surveys (ACS) on the Hubble Space Telescope (HST). We tracked the SMC’s motion relative to 5 background QSOs over a baseline of approximately 2 years. The measured proper motion is : \( \mu_W = -1.16 \pm 0.18 \text{ mas yr}^{-1}, \mu_N = -1.17 \pm 0.18 \text{ mas yr}^{-1} \). This is the best measurement yet of the SMC’s proper motion. We combine the new result with our estimate of the proper motion of the Large Magellanic Cloud (LMC) from the same observing program (Kallivayalil et al. 2006) to investigate the orbital evolution of both Clouds over the past 9 Gyr. The current relative velocity between the Clouds is 105 \pm 42 \text{ km s}^{-1}. Our investigations of the past orbital motions of the Clouds in a simple model for the dark halo of the Milky Way imply that the Clouds could be unbound from each other. However, our data are also consistent with orbits in which the Clouds have been bound to each other for approximately a Hubble time. Smaller proper motion errors and better understanding of the LMC and SMC masses would be required to constrain their past orbital history and their bound vs. unbound nature unambiguously. The new proper motion measurements should be sufficient to allow the construction of improved models for the origin and properties of the Magellanic Stream. In turn, this will provide new constraints on the properties of the Milky Way dark halo.

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The Role of Evolutionary Age and Metallicity in the Formation of Classical Be Circumstellar Disks I. New Candidate Be Stars in the LMC, SMC, and Milky Way

John P. Wisniewski and Karen S. Bjorkman

We present B, V, R, and H\(_\text{\textregistered}\) photometry of 8 clusters in the Small Magellanic Cloud, 5 in the Large Magellanic Cloud, and 3 Galactic clusters, and use 2 color diagrams (2-CDs) to identify candidate Be star populations in these clusters. We find evidence that the Be phenomenon is enhanced in low metallicity environments, based on the observed fractional early-type candidate Be star content of clusters of age 10-25 Myr. Numerous candidate Be stars of spectral types B0 to B5 were identified in clusters of age 5-8 Myr, challenging the suggestion of Fabregat & Torrejon (2000) that classical Be stars should only be found in clusters at least 10 Myr old. These results suggest that a significant number of B-type stars must emerge onto the zero-age-main-sequence as rapid rotators. We also detect an enhancement in the fractional content of early-type candidate Be stars in clusters of age 10-25 Myr, suggesting that the Be phenomenon does become more prevalent with evolutionary age. We briefly discuss the mechanisms which might contribute to such an evolutionary effect. A discussion of the limitations of utilizing the 2-CD technique to investigate the role evolutionary age and/or metallicity play in the development of the Be phenomenon is offered, and we provide evidence that other B-type objects of very different nature, such as candidate Herbig Ae/Be stars may contaminate the claimed detections of “Be stars” via 2-CDs.

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The Star-Forming Region NGC 346 in the Small Magellanic Cloud with Hubble Space Telescope ACS Observations I. Photometry

D. A. Gouliermis, A. E. Dolphin, W. Brandner, and Th. Henning

We present a photometric study of the star-forming region NGC 346 and its surrounding field in the Small Magellanic Cloud, using data taken with the Advanced Camera for Surveys (ACS) on board the Hubble Space Telescope (HST). The data set contains both short and long exposures for increased dynamic range, and photometry was performed using the ACS module of the stellar photometry package DOLPHOT. We detected almost 100,000 stars over a magnitude range of V \(\sim\) 11 to V \(\sim\) 28 mag, including all stellar types from the most massive young stars to faint lower main sequence and pre-main sequence stars. We find that this region, which is characterized by a plethora of stellar systems and interesting objects, is an outstanding example of mixed stellar populations. We take into account different features of the color-magnitude diagram of all the detected stars to distinguish the two dominant stellar systems: The stellar association NGC 346 and the old spherical star cluster BS 90. These observations provide a complete stellar sample of a field about 5 arcmin \(\times\) 5 arcmin around the most active star-forming region in this galaxy. Considering the importance of these data for various investigations in the area, we provide the full stellar catalog from our photometry. This paper is the first part of an ongoing study to investigate in detail the two dominant stellar systems in the area and their surrounding field.

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The remarkable light and colour variability of Small Magellanic Cloud Be stars

W.J. de Wit1, H.J.G.L.M. Lamers2,3, J.B. Marquette4 and J.P. Beaulieu4

1Laboratoire d’Astrophysique de Grenoble, Université Joseph Fourier, BP 53, 38041 Grenoble Cedex 9, France
2Astronomical Institute, Utrecht University, Princetonplein 5, 3584 CC Utrecht, The Netherlands
3SRON Laboratory for Space Research, Sorbonnelaan 2, 3584 CA Utrecht, The Netherlands
4Institut d’Astrophysique de Paris, 98bis Boulevard Arago, 75014 Paris, France

Some 240 blue stars in the Small Magellanic Cloud are investigated on their fantastic irregular continuum variability. We report here two results regarding these stars. First, their optical flux excess is correlated to their near-IR flux excess, as determined from optical EROSII light curves and 2MASS measurements. Second, the relation between optical colour and magnitude is observed to be bi-valued in 40% of the cases, resulting in a "loop" when the light curve is presented in a colour-magnitude diagram. We argue that optical variability for a large fraction of the variable stars is due to variations in the amount of bound-free and free-free radiation. We do simple model calculations that allow us to interpret the observed colour-magnitude variability as due to an outflowing ionized circumstellar disk. The mass loss of the central star is variable, i.e. on or off. Once the star stops losing mass, the disk evolves naturally into a ring. The observed bi-valued colour-magnitude relation is the transition of a partially optically thick to a fully optically thin disk. Significantly, the loop is traversed clockwise by outflowing matter, but anti-clockwise by infalling matter. It is observed that the material is generally outflowing, but few cases of inflow are also observed.

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The Unusual Spitzer Spectrum of the Carbon Star IRAS 04496–6958: A Different Condensation Sequence in the LMC?

Angela K. Speck1, Jan Cami2, Ciska Markwick-Kemper3, Jarron Leisenring3, Ryszard Szczerba4, Catharinus Dijkstra1, Schuyler Van Dyk5 and Margaret Meixner6

1Department of Physics & Astronomy, University of Missouri - Columbia, USA
2SETI Institute at NASA Ames Research Center, USA
3Department of Astronomy, University of Virginia, USA
4N. Copernicus Astronomical Center, Poland
5Spitzer Science Center, Caltech, USA
6Space Telescope Science Institute, USA

We present a new Spitzer Infrared Spectrograph (IRS) spectrum of the carbon star IRAS 04496–6958 in the Large Magellanic Cloud, which exhibits a fairly broad absorption feature at ~11 μm. This feature is consistent with SiC absorption as seen in a few Galactic sources. Furthermore, the C3H2 (and other molecular) absorption bands are the deepest ever observed, indicative of a very high column density. While the Galactic sources with SiC absorption have cool colors (continuum temperature ~300 K), IRAS 04496–6958 is much bluer, with a continuum temperature of ~600 K. Based on the Galactic sample, SiC dust at this temperature should still display an emission feature at ~11 μm. If SiC is the cause of the absorption feature, it suggests a subtly different evolutionary path and a change to a different condensation sequence than assumed for Galactic carbon stars. An alternative explanation for this feature is molecular line absorption, however, currently available line lists are not sufficient to properly assess this hypothesis.

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The period-luminosity relation for type II Cepheids in globular clusters

N. Matsunaga\(^1\), H. Fukushi\(^1\), Y. Nakada\(^2\), T. Tanabe\(^1\), M. W. Feast\(^3\), J. W. Menzies\(^4\), Y. Ita\(^5\), S. Nishiyama\(^6\), D. Baba\(^6\), T. Naoi\(^5\), H. Nakaya\(^7\), T. Kawadu\(^8\), A. Ishihara\(^9\);\(^10\) and D. Kato\(^6\)

\(^1\)Institute of Astronomy, School of Science, the University of Tokyo, Japan
\(^2\)Kiso Observatory, Institute of Astronomy, School of Science, the University of Tokyo, Japan
\(^3\)Astronomy Department, University of Cape Town, South Africa
\(^4\)South African Astronomical Observatory, South Africa
\(^5\)Institute of Space and Astronomical Science, Japan Aerospace Exploration Agency, Japan
\(^6\)Department of Astrophysics, Nagoya University, Japan
\(^7\)Subaru Telescope, National Astronomical Observatory of Japan, USA
\(^8\)Department of Astronomy, Kyoto University, Japan
\(^9\)National Astronomical Observatory of Japan, Japan
\(^10\)Department of Earth and Planetary Science, School of Science, the University of Tokyo, Japan

We report the result of our near-infrared observations (JHK\(_s\)) for type II Cepheids (including possible RV Tau stars) in galactic globular clusters. We detected variations of 46 variables in 26 clusters (10 new discoveries in seven clusters) and present their light curves. Their periods range from 1.2 d to over 80 d. They show a well-defined period-luminosity relation at each wavelength. Two type II Cepheids in NGC6441 also obey the relation if we assume the horizontal branch stars in NGC6441 are as bright as those in metal-poor globular clusters in spite of the high metallicity of the cluster. This result supports the high luminosity which has been suggested for the RR Lyr variables in this cluster. The period-luminosity relation can be reproduced using the pulsation equation (\(P^2 = Q\)) assuming that all the stars have the same mass. Cluster RR Lyr variables were found to lie on an extrapolation of the period-luminosity relation. These results provide important constraints on the parameters of the variable stars.

Using Two Micron All-Sky Survey (2MASS) data, we show that the type II Cepheids in the Large Magellanic Cloud (LMC) fit our period-luminosity relation within the expected scatter at the shorter periods. However, at long periods (\(P > 40\) d, i.e. in the RV Tau star range) the LMC field variables are brighter by about one magnitude than those of similar periods in galactic globular clusters. The long-period cluster stars also differ from both these LMC stars and galactic field RV Tau stars in a colour-colour diagram. The reasons for these differences are discussed.

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Common Correlations between 60, 100 and 140 \(\mu\)m Intensities in the Galactic Plane and Magellanic Clouds

Yasunori Hibi\(^1\), Hiroshi Shibai\(^1\), Mitsunobu Kawada\(^1\), Takafumi Ootsubo\(^1\) and Hiroyuki Hirashita\(^2\)

\(^1\)Graduate School of Science, Nagoya University, Japan
\(^2\)Center for Computational Sciences, University of Tsukuba, Japan

We investigate the far-infrared SED of the Galaxy and the Magellanic Clouds by using the COBE (COSmic Background Explorer) / DIRBE (Diffuse InfraRed Background Experiment) ZSMA (Zodi - Subtracted Mission Average) maps at wavelengths of 60 \(\mu\)m, 100 \(\mu\)m and 140 \(\mu\)m. We analyze three regions: the Galactic plane region with the Galactic latitude \(|b| < 5^\circ\), the Large Magellanic Cloud (LMC) region, and the Small Magellanic Cloud (SMC) region. Because the dust optical depth is much smaller in the far-infrared than in the visible, we may observe cumulative far-infrared radiation from regions with various interstellar radiation field (IRSF) in a line of sight. As consequence of considering such an effect, we find a common far-infrared color correlation between the 140–100 \(\mu\)m and 60–100 \(\mu\)m intensity ratios in all the three galaxies. Although this color correlation cannot be explained by any existing model, it fits very well the far-infrared color of nearby star forming galaxies.

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Nonlinear Period-Luminosity Relation for the Large Magellanic Cloud Cepheids: Myths and Truths

C. Ngeow\textsuperscript{1} and S. Kanbur\textsuperscript{2}

\textsuperscript{1}UIUC, USA \\
\textsuperscript{2}SUNY-OSWEGO, USA

In this paper, we discuss and examine various issues concerning the recent findings that suggested the observed period-luminosity (P-L) relation for the Large Magellanic Cloud (LMC) Cepheids is nonlinear. These include (1) visualizing the nonlinear P-L relation; (2) long period Cepheids and sample selection; (3) outlier removal; (4) issues of extinction; (5) nonlinearity of the period-color (P-C) relation; (6) nonlinear P-L relations in different pass-bands; and (7) universality of the P-L relation. Our results imply that a statistical test is needed to detect the nonlinear P-L relation. We then show that sample selection, number of long period Cepheids in the sample, outlier removal and extinction errors are unlikely to be responsible for the detection of the nonlinear P-L relation. We also argue for the existence of a nonlinear P-L relation from the perspective of the nonlinear P-C relation and the non-universality of the P-L relation. Combining the evidence and discussion from these aspects, we find that there is a strong indication that the observed LMC P-L relation is indeed nonlinear in the optical bands (however the K-band LMC P-L relation is apparently linear). This could be due to the internal physical reasons or the external hidden/additional factors. Compared to the non-linear P-L relation, the systematic error in distance scale introduced from using the (incorrect) linear P-L relation is at most at a few per cent level. While this is small compared to other systematic errors, it will be important in future efforts to produce a Cepheid distance scale accurate to one per cent in order to remove degeneracies presented in CMB results.

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The dwarf satellites of M 31 and the Galaxy

Sidney van den Bergh\textsuperscript{1}

\textsuperscript{1}Dominion Astrophysical Observatory, Herzberg Institute of Astrophysics, National Research Council of Canada, Canada

The satellite systems of M 31 and the Galaxy are compared. It is noted that all five of the suspected stripped dSph cores of M 31 companions are located within a projected distance of 40 kpc from the nucleus of this galaxy, whereas the normal dSph companions to this object have distances > 40 kpc from the center of M 31. All companions within 200 kpc < D(M 31) < 600 kpc are late-type objects. In one respect the companions to the Galaxy appear to exhibit different systematics with the irregular LMC and SMC being located at small $R_{gc}$. It is speculated that this difference might be accounted for by assuming that the Magellanic Clouds are interlopers that were originally formed in the outer reaches of the Local Group. The radial distribution of the total sample of 40 companions of M 31 and the Galaxy, which is shown in Figure 1, may hint at the possibility that these objects contain distinct populations of core ($R < 25$ kpc) and halo ($R > 25$ kpc) satellites.

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Spitzer Survey of the Large Magellanic Cloud, Surveying the Agents of a Galaxy’s Evolution (SAGE) I: Overview and Initial Results


1STScI, USA
2Univ. of Arizona, Steward Observatory, USA
3University of Virginia, USA
4Harvard-Smithsonian, CfA, USA
5Space Science Institute, USA
6CTIO/NOAO, USA
7Spitzer Science Center/JPL, USA
8Centre d’Etude Spatiale des Rayonnements, France
9Department of Astronomy, University of Wisconsin, USA
10University of California, Berkeley, USA
11Institut d’Astrophysique de Paris, France
12AURA, Inc., USA
13Nagoya University, Dept. of Astrophysics, Japan
14JPL, USA
15Johns Hopkins University, Department of Physics and Astronomy, USA
16Service d’Astrophysique CEA, France
17NOAO, Tucson, USA
18University of Michigan, Dept. of Astronomy, USA
19University of College, London, Dept. of Physics and Astronomy, UK
20Commonwealth Science and Industrial Research Organization (CSIRO), Australia
21NASA Ames Research Center, USA
22URSA/NASA Ames Research Center, USA
23Gemini Observatory, Northern Operations Center, USA

We are performing a uniform and unbiased imaging survey of the Large Magellanic Cloud (LMC, ~7° × 7°), using the IRAC (3.6, 4.5, 5.8 and 8 µm) and MIPS (24, 70, and 160 µm) instruments on board the Spitzer Space Telescope (Spitzer) in order to survey the agents of a galaxy’s evolution (SAGE), the interstellar medium (ISM) and stars in the LMC. This paper provides an overview of the SAGE legacy project including observing strategy, data processing and initial results. Three key science goals determined the coverage and depth of the survey. The detection of diffuse ISM with column densities > 1.2 × 10²¹ H cm⁻² permits detailed studies of dust processes in the ISM. SAGEs point source sensitivity enables a complete census of newly formed stars with masses > 3 M⊙ that will determine the current star formation rate in the LMC. SAGEs detection of evolved stars with mass loss rates > 1 × 10⁻⁸ M⊙ yr⁻¹ will quantify the rate at which evolved stars inject mass into the ISM of the LMC. The observing strategy includes two epochs in 2005, separated by three months, that both mitigate instrumental artifacts and constrain source variability. The SAGE data are non-proprietary. The data processing includes IRAC and MIPS pipelines and a database for mining the point source catalogs, which will be released to the community in support of Spitzer proposal cycles 4 and 5. We present initial results on the epoch 1 data for a region near N79 and N83. The MIPS 70 and 160 µm images of the diffuse dust emission of the N79/N83 region reveal a similar distribution to the gas emissions, especially the H I 21 cm emission. The measured point source sensitivity for the epoch 1 data is consistent with expectations for the survey. The point source counts are highest for the IRAC 3.6 µm band and decrease dramatically towards longer wavelengths consistent with the fact that stars dominate the point source catalogs and that the dusty objects detected at the longer wavelengths are rare in comparison. The SAGE epoch 1 point source catalog has ~ 4 × 10⁸ sources and more are anticipated when the epoch 1 and 2 data are combined. Using Milky Way (MW) templates as a guide, we adopt a simplified point source classification to identify three candidate groups, stars without dust, dusty evolved stars and...
young stellar objects, that offers a starting point for this work. We outline a strategy for identifying foreground MW stars, that may comprise as much as 18% of the source list, and background galaxies, that may comprise \sim 12% of the source list.

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Physical properties of two compact high-velocity clouds possibly associated with the Leading Arm of the Magellanic System

N. Ben Bekhti\textsuperscript{1}, C. Br"uns\textsuperscript{1}, J. Kerp\textsuperscript{1} and T. Westmeier\textsuperscript{1}

\textsuperscript{1}Argelander-Institut f"ur Astronomie, Bonn, Germany

We observed two compact high-velocity clouds HVC 291+26+195 and HVC 297+09+253 to analyse their structure, dynamics, and physical parameters. In both cases there is evidence for an association with the Leading Arm of the Magellanic Clouds. The goal of our study is to learn more about the origin of the two CHVCs and to use them as probes for the structure and evolution of the Leading Arm.

We have used the Parkes 64-m radio telescope and the Australia Telescope Compact Array (ATCA) to study the two CHVCs in the 21-cm line emission of neutral hydrogen. The observations with a single-dish and a synthesis telescope allow us to analyse both the diffuse, extended emission as well as the small-scale structure of the clouds. We present a method to estimate the distance of the two CHVCs.

The investigation of the line profiles of HVC 297+09+253 reveals the presence of two line components in the spectra which can be identified with a cold and a warm gas phase. In addition, we find a distinct head-tail structure in combination with a radial velocity gradient along the tail, suggesting a ram-pressure interaction of this cloud with an ambient medium. HVC 291+26+195 has only a cold gas phase and no head-tail structure. The ATCA data show several cold, compact clumps in both clouds which, in the case of HVC 297+09+253, are embedded in the warm, diffuse envelope. All these clumps have very narrow H\textsc{i} lines with typical line widths between 2 and 4 km s\textsuperscript{-1} FWHM, yielding an upper limit for the kinetic temperature of the gas of $T_{\text{max}} = 300$ K. We obtain distance estimates for both CHVCs of the order of 10 to 60 kpc, providing additional evidence for an association of the clouds with the Leading Arm. Assuming a distance of 50 kpc, we get H\textsc{i} masses of $5.9 \times 10^3 M_\odot$ and $4.0 \times 10^4 M_\odot$ for HVC 291+26+195 and HVC 297+09+253, respectively.

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Supernova Remnants in the Magellanic Clouds. VII. Infrared Emission from SNRs

R. N. M. Williams\textsuperscript{1}, Y.-H. Chu\textsuperscript{1} and R. A. Gruendl\textsuperscript{1}

\textsuperscript{1}University of Illinois, USA

We have used the instruments on the Spitzer Space Telescope to study the Large Magellanic Cloud supernova remnants (SNRs) N11L, N44, N49, N206, N63A, and N157B. The two large SNRs N44 and N206 were not detected in any IRAC or MIPS wavebands; the remainder were detected at one or more wavelengths. In particular, the SNRs N49 and N63A each had features that were evident in all available IRAC and MIPS bands. Each of these two also displayed faint limb emission in the MIPS 24 $\mu$m band only. IRS spectra obtained for the N49 SNR showed a number of prominent lines, with little continuum contribution. We therefore suggest that N49, and possibly N63A, are dominated by line emission, with thermal emission from hot dust being at most a secondary component.

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A Database of 2MASS Near-Infrared Colors of Magellanic Cloud Star Clusters

Peter M. Pessev¹, Paul Goudfrooij², Thomas H. Puzia¹ and Rupali Chandar²

¹STScI, USA
²JHU, USA

The (rest-frame) near-IR domain contains important stellar population diagnostics and is often used to estimate masses of galaxies at low as well as high redshifts. However, many stellar population models are still relatively poorly calibrated in this part of the spectrum. To allow an improvement of this calibration we present a new database of integrated near-infrared JHKₗ magnitudes for 75 star clusters in the Magellanic Clouds, using the 2-Micron All-Sky Survey (2MASS). The majority of the clusters in our sample have robust age and metallicity estimates from color-magnitude diagrams available in the literature, and populate a range of ages from 10 Myr to 15 Gyr and a range in [Fe/H] from −2.17 to +0.01 dex. A comparison with matched star clusters in the 2MASS Extended Source Catalog (XSC) reveals that the XSC only provides a good fit to the unresolved component of the cluster stellar population. We also compare our results with the often-cited single-channel JHK photometry of Persson and collaborators, and find significant differences, especially for their 30''-diameter apertures up to ~2.5 mag in the K-band, more than 1 mag in J-K, and up to 0.5 mag in H-K. Using simulations to center apertures based on maximum light throughput (as performed by Persson et al, we show that these differences can be attributed to near-IR-bright cluster stars (e.g., Carbon stars) located away from the true center of the star clusters. The wide age and metallicity coverage of our integrated JHKₗ photometry sample constitutes a fundamental dataset for testing population synthesis model predictions, and for direct comparison with near-IR observations of distant stellar populations.

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Conference Papers

Spitzer Spectra of Magellanic Cloud Planetary Nebulae

L. Stanghellini¹, P. García-Lario², A. Manchado³, J. V. Perea-Calderón², D. A. García-Hernández², R. A. Shaw¹ and E. Villaver⁴

¹NOAO, USA
²ESAC, Spain
³IAC, Spain
⁴STScI and ESA, USA

Planetary nebulae (PNe) in the Magellanic Clouds (LMC, SMC) offer a unique opportunity to study both the population and evolution of low- and intermediate-mass stars in an environment which is free of the distance scale bias that hinder Galactic PN studies. The emission shown by PNe in the 5–40 μm range is characterized by the presence of a combination of solid state features (from the dust grains) and nebular emission lines over-imposed on a strong dust continuum. We acquired low resolution IRS spectroscopy of a selected sample of LMC and SMC PNe whose morphology, size, central star brightness, and chemical composition are known. The data have been acquired and reduced, and the IRS spectra show outstanding quality as well as very interesting features. The preliminary analysis presented here allows to determine strong correlations between gas and dust composition, and nebular morphology. More detailed analysis in the future will deepen our knowledge of mass-loss mechanism, its efficiency, and its relation to PN morphology.

Oral contribution, published in IAU Symposium 234, Planetary Nebulae
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The Small Magellanic Cloud (SMC) is the only dwarf galaxy in the Local Group known to have formed and preserved populous star clusters continuously over the past 12 Gyr. These clusters provide a unique, closely spaced set of single-age, single-metallicity tracers for a detailed study of the SMC’s age-metallicity relation. Spectroscopic metallicity measurements, however, exist only for 6 of its clusters. Here we present metallicities for 7 additional SMC clusters based on Ca\textsc{ii} triplet observations. The total sample comprises clusters spanning an age range of 12 Gyr. Complemented by age estimates from literature these objects provide us with a well-sampled, well-defined age-metallicity relation. We compare our first results with the chemical evolution history of the SMC in terms of a simple closed box model. We find that the general trend is well reproduced by this model.

Oral contribution, published in "Globular Clusters — Guides to Galaxies", Concepción, Chile, March 6th-10th, 2006

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See also http://star.arm.ac.uk/jobs/res-ast-2006/