Editorial

Dear Colleagues,

It is our pleasure to present the 91st issue of the Magellanic Clouds Newsletter, with many very nice papers to read.

The organisers of IAU Symposium 256 on the Magellanic System have issued a first announcement (see the end of this newsletter), and the webpages have been updated. The web version of the announcement is accompanied with some nice pictures. It is now possible to propose contributions; the SOC is looking forward to be impressed by the originality and excitement of your abstracts.

Don’t miss the other announcements! The VISTA near-infrared survey of the Magellanic Clouds has now been officially approved, and PhD and MSc opportunities are offered at Hertfordshire to work on this mega-project.

Furthermore, an extended database of FUSE (UV) spectra of hot stars in the Magellanic Clouds has been made available for you to play with.

The next issue will be distributed on the 30th of March 2008; the deadline for contributions is the 29th of March.

Editorially Yours,
Jacco van Loon and Snežana Stanimirović
The Formation of Constellation III in the Large Magellanic Cloud

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We present a detailed reconstruction of the star-formation history of the Constellation III region in the Large Magellanic Cloud, to constrain the formation mechanism of this enigmatic feature. Star formation in Constellation III seems to have taken place during two distinct epochs: there is the 8-15 Myr epoch that had previously been recognized, but we also see strong evidence for a separate "burst" of star formation 25-30 Myr ago. The "super-supernova" or GRB blast wave model for the formation of Constellation III is difficult to reconcile with such an extended, two-epoch star formation history, because the shock wave should have induced star formation throughout the structure simultaneously, and any unconsumed gas would quickly be dissipated, leaving nothing from which to form a subsequent burst of activity. We propose a "truly stochastic" self-propagating star formation model, distinct from the canonical model in which star formation proceeds in a radially-directed wave from the center of Constellation III to its perimeter. As others have noted, and we now confirm, the bulk age gradients demanded by such a model are simply not present in Constellation III. In our scenario, the prestellar gas is somehow pushed into these large-scale arc structures, without simultaneously triggering immediate and violent star formation throughout the structure. Rather, star formation proceeds in the arc according to the local physical conditions of the gas. Self-propagating star formation is certainly possible, but in a truly stochastic manner, without a directed, large scale pattern.

Accepted for publication in Publications of the Astronomical Society of Australia

Available from arXiv:0712.2077

Low Metallicity Indicates that the Hypervelocity Star HE\,0437$-5439$ was Ejected from the LMC

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We measure the metallicity of the unusual hypervelocity star HE\,0437$-5439$ from high resolution spectroscopy to be half-solar. We determine a spectral type of B2III-IV for the star and derive an effective temperature $T_{\text{eff}} = 22,000 \pm 1,000$ K and a surface gravity $\log g = 4.00 \pm 0.25$ (cgs). We also present BV time series photometry and find the star to be non-variable at the 0.02 mag level. We refine the magnitude of the hypervelocity star to $V = 16.36 \pm 0.04$ mag, with a color $B - V = -0.23 \pm 0.03$ mag, confirming its early-type nature. Our metallicity result establishes the origin of HE\,0437$-5439$ in the Large Magellanic Cloud and implies the existence of a massive black hole somewhere in this galaxy.

Submitted to Astrophysical Journal Letters

Available from arXiv:0712.1825
An Interaction of a Magellanic Leading Arm High Velocity Cloud with the Milky Way Disk

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The Leading Arm of the Magellanic System is a tidally formed H\textsubscript{i} feature extending $\sim 60\degree$ from the Magellanic Clouds ahead of their direction of motion. Using atomic hydrogen (H\textsubscript{i}) data from the Galactic All Sky-Survey (GASS), supplemented with data from the Australia Telescope Compact Array, we have found evidence for an interaction between a cloud in the Leading Arm and the Galactic disk where the Leading Arm crosses the Galactic plane. The interaction occurs at velocities permitted by Galactic rotation, which allows us to derive a kinematic distance to the cloud of 21 kpc, suggesting that the Leading Arm crosses the Galactic Plane at a Galactic radius of $R \approx 17$ kpc.

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Infrared and X-Ray Evidence for Circumstellar Grain Destruction by the Blast Wave of Supernova 1987A

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Multiwavelength observations of supernova remnant (SNR) 1987A show that its morphology and luminosity are rapidly changing at X-ray, optical, infrared, and radio wavelengths as the blast wave from the explosion expands into the circumstellar equatorial ring, produced by mass loss from the progenitor star. The observed infrared (IR) radiation arises from the interaction of dust grains that formed in mass outflow with the soft X-ray emitting plasma component of the shocked gas. Spitzer IRS spectra at 5–30 $\mu$m taken on day 6190 since the explosion show that the emission arises from $\sim 1.1 \times 10^{-6}$ M\textsubscript{\odot} of silicate grains radiating at a temperature of $\sim 180^{+20}_{-15}$ K. Subsequent observations on day 7137 show that the IR flux had increased by a factor of 2 while maintaining an almost identical spectral shape. The observed IR-to-X-ray flux ratio (IRX) is consistent with that of a dusty plasma with standard Large Magellanic Cloud dust abundances. IRX has decreased by a factor of $\sim 2$ between days 6190 and 7137, providing the first direct observation of the ongoing destruction of dust in an expanding SN blast wave on dynamic time scales. Detailed models consistent with the observed dust temperature, the ionization timescale of the soft X-ray emission component, and
the evolution of IRX suggest that the radiating silicate grains are immersed in a $3.5 \times 10^6$ K plasma with a density of $(0.3 - 1) \times 10^4$ cm$^{-3}$, and have a size distribution that is confined to a narrow range of radii between 0.023 and 0.22 μm. Smaller grains may have been evaporated by the initial UV flash from the supernova.

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The VLT-FLAMES survey of massive stars: atmospheric parameters and rotational velocity distributions for B-type stars in the Magellanic Clouds

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Aims: We aim to provide the atmospheric parameters and rotational velocities for a large sample of O- and early B-type stars, analysed in a homogeneous and consistent manner, for use in constraining theoretical models.

Methods: Atmospheric parameters, stellar masses, and rotational velocities have been estimated for approximately 250 early B-type stars in the Large (LMC) and Small (SMC) Magellanic Clouds from high-resolution VLT-FLAMES data using the non-LTE TLUSTY model atmosphere code. This data set has been supplemented with our previous analyses of some 50 O-type stars (Mokiem et al. 2006, 2007) and 100 narrow-lined early B-type stars (Hunter et al. 2006, Trundle et al. 2007) from the same survey, providing a sample of ~ 400 early-type objects.

Results: Comparison of the rotational velocities with evolutionary tracks suggests that the end of core hydrogen burning occurs later than currently predicted and we argue for an extension of the evolutionary tracks. We also show that the large number of the luminous blue supergiants observed in the fields are unlikely to have directly evolved from main-sequence massive O-type stars as neither their low rotational velocities nor their position on the H-R diagram are predicted. We suggest that blue loops or mass-transfer binary systems may populate the blue supergiant regime. By comparing the rotational velocity distributions of the Magellanic Cloud stars to a similar Galactic sample, we find that (at 3σ confidence level) massive stars (above 8 $M_\odot$) in the SMC rotate faster than those in the solar neighbourhood. However there appears to be no significant difference between the rotational velocity distributions in the Galaxy and the LMC. We find that the vsini distributions in the SMC and LMC can modelled with an intrinsic rotational velocity distribution that is a Gaussian peaking at 175 km s$^{-1}$ (SMC) and 100 km s$^{-1}$ (LMC) with a 1/e half width of 150 km s$^{-1}$. We find that in NGC 346 in the SMC, the 10–25 $M_\odot$ main-sequence stars appear to rotate faster than their higher mass counterparts. It is not expected that O-type stars spin down significantly through angular momentum loss via stellar winds at SMC metallicity, hence this could be a reflection of mass dependent birth spin rates. Recently Yoon et al. (2006) have determined rates of GRBs by modelling rapidly rotating massive star progenitors. Our measured rotational velocity distribution for the 10–25 $M_\odot$ stars is peaked at slightly higher velocities than they assume, supporting the idea that GRBs could come from rapid rotators with initial masses as low as 14 $M_\odot$ at low metallicities.

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Proper Motions of the LMC and SMC: Reanalysis of Hubble Space Telescope Data

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Kallivayalil et al. have used the Hubble Space Telescope to measure proper motions of the LMC and SMC using images in 21 and five fields, respectively, all centered on known QSOs. These results are more precise than previous measurements, but have surprising and important physical implications: for example, the LMC and SMC may be approaching the Milky Way for the first time; they might not have been in a binary system; and the origin of the Magellanic Stream needs to be re-examined. Motivated by these implications, we have reanalyzed the original data in order to check the validity of these measurements. Our work has produced a proper motion for the LMC that is in excellent agreement with that of Kallivayalil et al., and for the SMC that is in acceptable agreement.

We have detected a dependence between the brightness of stars and their mean measured motion in a majority of the fields in both our reduction and that of Kallivayalil et al. Correcting for this systematic error and for the errors caused by the decreasing charge transfer efficiency of the detector produces better agreement between the measurements from different fields. With our improved reduction, we do not need to exclude any fields from the final averages and, for the first time using proper motions, we are able to detect the rotation of the LMC. The best-fit amplitude of the rotation curve at a radius of 275 arcmin in the disk plane is \(120 \pm 15 \text{ km s}^{-1}\). This value is larger than the 60–70 km s\(^{-1}\) derived from the radial velocities of \(\text{H} \text{I}\) and carbon stars, but in agreement with the value of 107 km s\(^{-1}\) derived from the radial velocities of red supergiants.

Our measured proper motion for the center of mass of the LMC is \((\mu_\alpha, \mu_\delta) = (195.6 \pm 3.6, 43.5 \pm 3.6) \text{ mas century}^{-1}\); that for the SMC is \((\mu_\alpha, \mu_\delta) = (75.4 \pm 6.1, -125.2 \pm 5.8) \text{ mas century}^{-1}\). The uncertainties for the latter proper motion are 3 times smaller than those of Kallivayalil et al.

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Topology of Neutral Hydrogen Within the Small Magellanic Cloud

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In this paper, genus statistics have been applied to an \(\text{H} \text{I}\) column density map of the Small Magellanic Cloud in order to study its topology. To learn how topology changes with the scale of the system, we provide the study of topology for column density maps at varying resolution. To evaluate the statistical error of the genus we randomly reassign the phases of the Fourier modes while keeping the amplitudes. We find, that at the smallest scales studied (26 pc \(\leq \lambda \leq 50\) pc) the genus shift is in all regions negative, implying a clump topology. At the larger scales (70 pc \(\leq \lambda \leq 150\) pc) the topology shift is detected to be negative in 4 cases and positive (“swiss cheese” topology) in 2 cases. In 4 regions there is no statistically significant topology shift.

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The Period-Luminosity Relation for the Large Magellanic Cloud Cepheids Derived from Spitzer

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Using Spitzer archival data from the SAGE (Surveying the Agents of a Galaxy’s Evolution) program, we derive the Cepheid period-luminosity (P-L) relation at 3.6, 4.5, 5.8 and 8.0 \textmu m for Large Magellanic Cloud (LMC) Cepheids. These P-L relations can be used, for example, in future extragalactic distance scale studies carried out with the James Webb Space Telescope. We also derive Cepheid period-color (P-C) relations in these bands and find that the slopes of the P-C relations are relatively flat. We test the nonlinearity of these P-L relations with the F statistical test, and find that the 3.6 \textmu m, 4.5 \textmu m and 5.8 \textmu m P-L relations are consistent with linearity. However the 8.0 \textmu m P-L relation presents possible but inconclusive evidence of nonlinearity.

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An Accurate Age Determination for the SMC Star Cluster NGC121 with HST/ACS

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As first Paper of a series devoted to study the old stellar population in clusters and fields in the Small Magellanic Cloud, we present deep observations of NGC 121 in the F555W and F814W filters, obtained with the Advanced Camera for Surveys on the Hubble Space Telescope. The resulting color-magnitude diagram reaches \textasciitilde 3.5 mag below the main-sequence turn-off; deeper than any previous data. We derive the age of NGC 121 using both absolute and relative age-dating methods. Fitting isochrones in the ACS photometric system to the observed ridge line of NGC 121, gives ages of 11.8 \pm 0.5 Gyr (Teramo), 11.2 \pm 0.5 Gyr (Padova) and 10.5 \pm 0.5 Gyr (Dartmouth). The cluster ridge line is best approximated by the alpha-enhanced Dartmouth isochrones. Placing our relative ages on an absolute age scale, we find ages of 10.9 \pm 0.5 Gyr (from the magnitude difference between the main-sequence turn-off and the horizontal branch) and 11.5 \pm 0.5 Gyr (from the absolute magnitude of the horizontal branch), respectively. These five different age determinations are all lower by 2-3 Gyr than the ages of the oldest Galactic globular clusters of comparable metallicity. Therefore we confirm the earlier finding that the oldest globular cluster in the Small Magellanic Cloud, NGC 121, is a few Gyr younger than its oldest counterparts in the Milky Way and in other nearby dwarf galaxies such as the Large Magellanic Cloud, Fornax, and Sagittarius. If it were accreted into the Galactic halo, NGC 121 would resemble the ”young halo globulars”, although it is not as young as the youngest globular clusters associated with the Sagittarius dwarf. The young age of NGC 121 could result from delayed cluster formation in the Small Magellanic Cloud or result from the random survival of only one example of an initially small number star clusters.

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Multibeam Maser Survey of methanol and excited OH in the Magellanic Clouds: new detections and maser abundance estimates


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We present the results of the first complete survey of the Large and Small Magellanic Clouds for 6668-MHz methanol and 6035-MHz excited-state hydroxyl masers. In addition to the survey, higher-sensitivity targeted searches towards known star-formation regions were conducted. The observations yielded the discovery of a fourth 6668-MHz methanol maser in the Large Magellanic Cloud (LMC), found towards the star-forming region N160a, and a second 6035-MHz excited-state hydroxyl maser, found towards N157a. We have also re-observed the three previously known 6668-MHz methanol masers and the single 6035-MHz hydroxyl maser. We failed to detect emission from either transition in the Small Magellanic Cloud. All observations were initially made using the Methanol Multibeam (MMB) survey receiver on the 64-m Parkes telescope as part of the MMB project and accurate positions have been measured with the Australia Telescope Compact Array (ATCA). We compare the maser populations in the Magellanic Clouds with those of our Galaxy and discuss their implications for the relative rates of massive star-formation, heavy metal abundance, and the abundance of complex molecules. The LMC maser populations are demonstrated to be smaller than their Milky Way counterparts. Methanol masers are under-abundant by a factor of ~45, whilst hydroxyl and water masers are a factor of ~10 less abundant than our Galaxy.

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CCD photometric and mass function study of 9 young Large Magellanic Cloud star clusters

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We present CCD photometric and mass function study of 9 young Large Magellanic Cloud star clusters namely NGC 1767, NGC 1994, NGC 2002, NGC 2003, NGC 2006, SL 538, NGC 2111, NGC 2098 and NGC 2136. The BVRI data reaching down to V ~ 21 mag, are collected from 3.5-meter NTT/EFOSC2 in sub-arcsec seeing conditions. For NGC 1767, NGC 1994, NGC 2002, NGC 2003, NGC 2006, NGC 2111 and NGC 2136, broad band photometric CCD data are presented for the first time. Seven of the 9 clusters have ages between 16 to 25 Myr while remaining two clusters have ages 32 ± 4 Myr (NGC 2098) and 90 ± 10 Myr (NGC 2136). For 7 younger clusters, the age estimates based on a recent model and the integrated spectra are found to be systematically lower (~ 10 Myr) from the present estimate. In the mass range of ~ 2 – 12 M☉, the MF slopes for 8 out of nine clusters were found to be similar with the value of γ ranging from −1.90 ± 0.16 to −2.28 ± 0.21. For NGC 1767 it is flatter with γ = −1.23 ± 0.27. Mass segregation effects are observed for NGC 2002, NGC 2006, NGC 2136 and NGC 2098. This is consistent with the findings of Kontizas et
al. for NGC 2098. Presence of mass segregation in these clusters could be an imprint of star formation process as their ages are significantly smaller than their dynamical evolution time. Mean MF slope of $\gamma = -2.22 \pm 0.16$ derived for a sample of 25 young ($\leq 100$ Myr) dynamically unevolved LMC stellar systems provide support for the universality of IMF in the intermediate mass range $\sim 2 - 12 M_\odot$.

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**Metallicity and Physical Conditions in the Magellanic Bridge**

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We present a new analysis of the diffuse gas in the Magellanic Bridge (RA$>$3h) based on HST/STIS E140M and FUSE spectra of 2 early-type stars lying within the Bridge and a QSO behind it. We derive the column densities of H\textsc{i} (from Ly\textsc{a}), N\textsc{i}, O\textsc{i}, Ar\textsc{i}, Si\textsc{ii}, Si\textsc{ii}, and Fe\textsc{ii} of the gas in the Bridge. Using the atomic species, we determine the first gas-phase metallicity of the Magellanic Bridge, $[Z/H]=-1.02 \pm 0.07$ toward one sightline, and $-1.7 < [Z/H] < -0.9$ toward the other one, a factor 2 or more smaller than the present-day SMC metallicity. Using the metallicity and N(H\textsc{i}), we show that the Bridge gas along our three lines of sight is $\sim 70 - 90\%$ ionized, despite high H\textsc{i} columns, log $N$(H\textsc{i}) $= 19.6 - 20.1$. Possible sources for the ongoing ionization are certainly the hot stars within the Bridge, hot gas (revealed by O\textsc{vi} absorption), and leaking photons from the SMC and LMC. From the analysis of C\textsc{ii}$^*$, we deduce that the overall density of the Bridge must be low ($< 0.03 - 0.1$ cm$^{-3}$). We argue that our findings combined with other recent observational results should motivate new models of the evolution of the SMC-LMC-Galaxy system.

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**The Cepheid Period-Luminosity Relation at Mid-Infrared Wavelengths: I First-Epoch LMC Data**

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We present the first mid-infrared Period-Luminosity (PL) relations for Large Magellanic Cloud (LMC) Cepheids. Single-epoch observations of 70 Cepheids were extracted from Spitzer IRAC observations at 3.6, 4.5, 5.8 and 8.0 $\mu$m, serendipitously obtained during the SAGE (Surveying the Agents of a Galaxy’s Evolution) imaging survey of the LMC. All four mid-infrared PL relations have nearly identical slopes over the period range 6–88 days, with a small scatter of only $\pm 0.16$ mag independent of period for all four of these wavelengths. We emphasize that differential reddening is not contributing significantly to the observed scatter, given the nearly two orders of magnitude reduced sensitivity of the mid-IR to extinction compared to the optical. Future observations, filling in the light curves for these Cepheids, should noticeably reduce the residual scatter. These attributes alone suggest that mid-infrared PL relations will provide a practical means of significantly improving the accuracy of Cepheid distances to nearby galaxies.

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Kinematics of massive stars in the Small Magellanic Cloud

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We present radial velocities for 2045 stars in the Small Magellanic Cloud (SMC), obtained from the 2dF survey by Evans et al. (2004). The great majority of these stars are of OBA type, tracing the dynamics of the young stellar population. Dividing the sample into \textit{ad hoc} ‘bar’ and ‘wing’ samples (north and south, respectively, of the line: \( \delta = -77^\circ 50' + [4\alpha] \), where \( \alpha \) is in minutes of time) we find that the velocities in the SMC bar show a gradient of 26.3 \( \pm 1.6 \) km s\(^{-1}\) deg\(^{-1}\) at a position angle of 126 \( \pm 4^\circ \). The derived gradient in the bar is robust to the adopted line of demarcation between the two samples. The largest redshifts are found in the SMC wing, in which the velocity distribution appears distinct from that in the bar, most likely a consequence of the interaction between the Magellanic Clouds that is predicted to have occurred 0.2 Gyr ago. The mean velocity for all stars in the sample is +172.0 \( \pm 0.2 \) km s\(^{-1}\) (redshifted by \( \sim 20 \) km s\(^{-1}\) when compared to published results for older populations), with a velocity dispersion of 30 km s\(^{-1}\).

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LMC origin of the hyper-velocity star HE 0437–5439. Beyond the supermassive black hole paradigm

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Context: Hyper-velocity stars move so fast that only a supermassive black hole (SMBH) seems to be capable to accelerate them. Hence the Galactic centre (GC) is their only suggested place of origin. Edelmann et al. (2005) found the early B-type star HE 0437–5439 to be too short-lived to have reached its current position in the Galactic halo if ejected from the GC, except if being a blue straggler star. Its proximity to the Large Magellanic Cloud (LMC) suggested an origin from this galaxy.

Aims: The chemical signatures of stars at the GC are significantly different from those in the LMC. Hence, an accurate measurement of the abundance pattern of HE 0437–5439 will yield a new tight constraint on the place of birth of this hyper-velocity star.

Methods: High-resolution spectra obtained with UVES on the VLT are analysed using state-of-the-art non-LTE modelling techniques.

Results: We measured abundances of individual elements to very high accuracy in HE 0437–5439 as well as in two reference stars, from the LMC and the solar neighbourhood, respectively. The abundance pattern is not consistent at all with that observed in stars near the GC, ruling out an origin from the GC. However, there is a high degree of consistency with the LMC abundance pattern. Our abundance results cannot rule out an origin in the outskirts of the Galactic disk. However, we find the life time of HE 0437–5439 to be more than three times shorter than the time of flight to the edge of the disk, rendering a Galactic origin unlikely.

Conclusions: Only one SMBH is known to be present in Galaxy and none in the LMC. Hence the exclusion of an GC origin challenges the SMBH paradigm. We conclude that there must be other mechanism(s) to accelerate stars to hyper-velocity speed than the SMBH. We draw attention to dynamical ejection from dense massive clusters, that has recently been proposed by Gvaramadze et al. (2008).

Accepted for publication in Astronomy & Astrophysics
Effects of metallicity on the chemical composition of carbon stars

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We present Spitzer IRS data on 19 asymptotic giant branch (AGB) stars in the Large Magellanic Cloud, complementing existing published data sets of carbon stars in both Magellanic Clouds and the Milky Way, to investigate the effects of metallicity on dust and molecular spectral features arising from the circumstellar envelope. We find that the C₂H₂ P and R branches at 7.5 μm are affected by dust dilution at higher mass-loss rates — albeit to a lesser extent for sources in the Magellanic Clouds, compared to the Milky Way — while the narrow 13.7 μm C₂H₂ Q branch only shows the effect of dust dilution at low mass-loss rates. A strong metallicity dependence is not observed for the Q branch. Independent of metallicity, we also provide an explanation for the observed shifts in the central wavelength of the SiC emission feature, as we show that these are largely caused by molecular band absorption on either side of the dust emission feature, dominating over shifts in the central wavelength caused by self-absorption. We have devised a method to study the dust condensation history in carbon-rich AGB stars in different metallicity environments, by measuring the strength of the 11.3 μm SiC and 30 μm MgS features with respect to the continuum, as a function of mass-loss rate. With this method, it is possible to distinguish in what order SiC and graphite condense, which is believed to be sensitive to the metallicity, prior to the eventual deposit of the MgS layer.

Submitted to Astrophysical Journal

The Magellanic Zoo: Mid-infrared Spitzer spectroscopy of evolved stars and circumstellar dust in the Magellanic Clouds

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We observed a sample of evolved stars in the Large and Small Magellanic Clouds (LMC and SMC) with the Infrared Spectrograph on the Spitzer Space Telescope. Comparing samples from the SMC, LMC, and the Galaxy reveals that the dust-production rate depends on metallicity for oxygen-rich stars, but carbon stars with similar pulsation properties produce similar quantities of dust, regardless of their initial metallicity. Other properties of the oxygen-rich stars also depend on metallicity. As the metallicity decreases, the fraction of naked (i.e. dust-free) stars increases, and among the naked stars, the strength of the 8 μm absorption band from SiO decreases. Our sample includes several massive stars in the LMC with long pulsation periods which produce significant amounts of dust, probably because they are young and relatively metal rich. Little alumina dust is seen in circumstellar shells in the SMC and LMC, unlike in Galactic samples. Three oxygen-rich sources also show emission from magnesium-rich crystalline silicates. Many also show an emission feature at 14 μm. The one S star in our sample shows a newly detected emission feature centered at 13.5 μm. At lower metallicity, carbon stars with similar amounts of amorphous carbon in their shells have stronger absorption from molecular acetylene (C₂H₂) and weaker emission from SiC and MgS dust, as discovered in previous studies.

Submitted to The Astrophysical Journal
A Comparison of Optical and Near-Infrared Colours of Magellanic Cloud Star Clusters with Predictions of Simple Stellar Population Models

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We present integrated JHKs 2MASS photometry and a compilation of integrated-light optical photoelectric measurements for 84 star clusters in the Magellanic Clouds. These clusters range in age from ≈ 200 Myr to > 10 Gyr, and have [Fe/H] values from −2.2 to −0.1 dex. We find a spread in the intrinsic colours of clusters with similar ages and metallicities, at least some of which is due to stochastic fluctuations in the number of bright stars residing in low-mass clusters. We use 54 clusters with the most reliable age and metallicity estimates as test particles to evaluate the performance of four widely used SSP models in the optical/NIR colour-colour space. All models reproduce the reddening-corrected colours of the old (≥ 10 Gyr) globular clusters quite well, but model performance varies at younger ages. In order to account for the effects of stochastic fluctuations in individual clusters, we provide composite B − V, B − J, V − J, V − Ks and J − Ks colours for Magellanic Cloud clusters in several different age intervals. The accumulated mass for most composite clusters are higher than that needed to keep luminosity variations due to stochastic fluctuations below the 10% level. The colours of the composite clusters are clearly distinct in optical-NIR colour-colour space for the following intervals of age: > 10 Gyr, 2 − 9 Gyr, 1 − 2 Gyr, and 200 Myr−1 Gyr. This suggests that a combination of optical plus NIR colours can be used to differentiate clusters of different age and metallicity.

Accepted for publication in MNRAS
Available from arXiv:0801.2375
and from http://www.astrosci.ca/users/puziat/HIA/Home_files/ms.pdf

Conference Papers

Young stellar populations in the Magellanic Clouds

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We discuss the young population of stars and clusters in the Magellanic Clouds. We present the discovery of pre-main sequence candidates in the nebula N 11 in the Large Magellanic Clouds on the basis of HST ACS photometry. The comparison of the Colour-Magnitude diagram with pre-main sequence tracks and the presence of Spitzer objects YSO I and II suggest that the star formation has been active for a long period in the region, from a few 10⁵ yrs to several Myr ago.

Oral contribution, published in ”XXI Century Challenges for stellar evolution”, Cefalú, August 2007
Available from arXiv:0711.4719
X-ray source populations in the Magellanic Clouds

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Early X-ray surveys of the Magellanic Clouds (MCs) were performed with the imaging instruments of the Einstein, ASCA and ROSAT satellites revealing discrete X-ray sources and large-scale diffuse emission. Large samples of supernova remnants, high and low mass X-ray binaries and super-soft X-ray sources could be studied in detail. Today, the major X-ray observatories XMM-Newton and Chandra with their advanced angular and spectral resolution and extended energy coverage are ideally suited for detailed population studies of the X-ray sources in these galaxies and to draw conclusions on our own Galaxy. We summarize our knowledge about the X-ray source populations in the MCs from past missions and present first results from systematic studies of the Small Magellanic Cloud (SMC) using the growing number of archival XMM-Newton observations.

Oral contribution, published in ESAC workshop ”X-rays from Nearby Galaxies”, to appear as MPE report 295

Available from arXiv:0712.2720

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Job Advert

University of Hertfordshire, UK PhD and MSc (by research) in Astrophysics

Opportunities to work on the Magellanic Clouds using the most sensitive near-infrared data that will be obtained as part of the VISTA public survey of the Magellanic System (VMC) are advertised below (check the list of projects).

The Centre for Astrophysics Research at the University of Hertfordshire is one of the largest astronomy research centres in the UK, offering a broad range of research topics at PhD and MSc level, as well as a comprehensive training programme. We expect to offer at least 6 STFC PhD studentships, open to EU and UK applicants resident in the UK, starting in October 2008. In addition, we may be able to offer one or more University studentships open also to non-UK residents (4 were offered in 2007) to study at PhD level. We also offer a 1-year MSc by Research degree, which is self-funded and open to both UK and non-UK residents.

For further information, entry and eligibility requirements, and details on how to apply, please see our web pages at:

http://car.herts.ac.uk/studentships.html

The closing date for applications is 15th February 2008.

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See also http://car.herts.ac.uk/studentships.html
Announcements

The VISTA near-infrared \( YJK_s \) survey of the Magellanic System (LMC, SMC, Bridge & Stream) – VMC

APPROVED

Dear Colleague,

I am very pleased to announce the final approval of the VMC survey. This is an ESO Public Survey with the new 4m VISTA telescope expected to begin operations this year. The preparation and acceptance of the proposal and management plan is the result of an international effort.

The Magellanic Cloud system represents the nearest template for the study of stellar populations and galaxy interactions. Its low metallicity and nearby distance are key issues to exploit the unique VMC data. This survey aims to obtain \( YJK_s \)-band photometry across the system down to \( K_s = 20.3 \) at \( S/N=10 \). This sensitivity corresponds to the bottom of the red giant branch field stellar population and allows us to determine the global spatially resolved star formation history with unprecedented quality (\( \sim 20\% \) errors at a resolution of 0.2 dex in age) and to construct a three-dimensional map of the system. A wide-area (184 sq. deg) encompassing the \( D_25 \) as well as major features delineated by the distribution of stars and \( H_\text{I} \) gas, will both trace the structure of the galaxies and signatures of past and present interactions. Contemporary optical and kinematic observations of comparable sensitivity (e.g. VST) will provide the community with a superior database for future studies of the system and will give us an excellent insight as to what has happened elsewhere in the Universe.

On behalf of the VMC team
Maria-Rosa Cioni (PI)

The FUSE Magellanic Clouds Legacy Project

The FUSE Magellanic Clouds Legacy Project is a new High Level Science Product available through the Multi-mission Archive at Space Telescope (MAST). It provides a Quick Look capability for scientists interested in the stellar and interstellar characteristics of the Magellanic Clouds, as discernible from the high resolution far ultraviolet spectral data obtained with the Far Ultraviolet Spectroscopic Explorer (FUSE) satellite. FUSE observed the \( 905-1187 \) Å region with a spectral resolution of \( \sim 20,000 \), corresponding to a velocity resolution of \( \sim 15 \) km s\(^{-1} \), depending somewhat on exact wavelength within the FUSE band.

Over its eight years in operations, FUSE was used to observe 187 hot stars in the Large Magellanic Cloud (LMC) and 100 hot stars in the Small Magellanic Cloud (SMC). Each FUSE spectrum contains a wealth of information, from the spectrum of the star itself to a broad range of interstellar absorption lines from both hot and cold gas, often at both rest velocity (from the Milky Way) and at the redshifted velocity of the appropriate Magellanic Cloud. Sifting through this complex mountain of data can be a daunting task for researchers interested in a particular science topic.

The FUSE Magellanic Clouds Legacy Project provides convenient on-line access to a broad range of summary information for each FUSE target to support the analysis of these data for a wide range of potential science programs. The FUSE data for all objects have been reprocessed with CalFUSE 3.2, the archival version of the FUSE calibration pipeline software. For stars with multiple observations, data have been aligned and summed, providing the highest S/N data directly to the user.
For each star, the FUSE data are shown in several standardized ways. Multi-panel plots on a velocity scale highlight a key set of interstellar absorption lines for quick assessment of the characteristics of the sight line. Another plot shows a broader spectral section from 1028–1042 Å that highlights the important O\textsc{vi} 1032 Å region, and another plot shows a compressed overview of the entire FUSE band, which highlights the general characteristics of the overall stellar spectrum in the FUSE band.

In addition to the FUSE data, the summary page for each object includes optical and infrared sight line context images, allowing further insights into the gaseous and dust components that may lie along each sight line. The optical data are from the Magellanic Cloud Emission Line Survey (MCELS) project, and the infrared images are from the Spitzer Space Telescope.

The FUSE Magellanic Clouds Legacy Project site is available directly at the following link:

http://archive.stsci.edu/prepds/fuse_mc/

We hope many people in the Magellanic Clouds community will find this new resource useful for their research.

This project has been funded by a NASA Cycle 5 FUSE grant NNG05GE03G to The Johns Hopkins University (PI: W. P. Blair).

See also http://archive.stsci.edu/prepds/fuse_mc/

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**IAU Symposium 256**

**The Magellanic System: Stars, Gas, and Galaxies**

First Announcement, 1 February 2008

The beautiful, green campus of the University of Keele cordially invites you to attend IAU Symposium 256 on "The Magellanic System: Stars, Gas, and Galaxies", from Monday 28 July to Friday 1 August 2008.

All details and forms can be found on the conference website http://www.astro.keele.ac.uk/iaus256

The last IAU Symposium dedicated to the Magellanic System took place ten years ago, in Victoria (Canada). Since then, there has been enormous progress in observing and understanding the physics and dynamics of the stars and the interstellar medium within these nearby gas-rich galaxies, as well as their global structure and mutual interaction.

**Programme**

IAU Symposium 256 is dedicated to all aspects of Magellanic Cloud research (including the Magellanic Bridge, Stream and Leading Arms) — see the programme for more details. We have invited a number of speakers to present key talks in certain areas, but we have ensured plenty of opportunity for contributed talks. We expect strong competition for these slots, however, and we therefore encourage anyone interested in presenting a talk to submit a convincing abstract by the 31 March 2008 deadline.

**Registration**

The fee for early (deadline 30 April 2008) is £120. This covers local administration costs, and includes a copy of the proceedings and conference stationary. The fee for registrations after this deadline is £150. Registration closes on 18 July 2008. The registration and payment form will go live in March 2008. Pre-registered delegates will be notified by e-mail when this happens.
Accommodation

We have booked accommodation on campus for about 200 participants. The packages include all meals, assuming arrival on Sunday afternoon and departure on Saturday morning (except dinner on the day of the conference dinner). Most rooms have en-suite facilities (£418 total). Some rooms with shared facilities are available at a cheaper rate (£351 total). A (very) limited number of double occupancy rooms have been booked as well (£429 total per delegate, but much cheaper for guests). All accommodation is allocated on a first come, first served basis upon registration. If you do not wish to take advantage of the accommodation packages you will still need to purchase a day delegate package (£137 total) in addition to the registration fee in order to be able to attend the symposium.

Financial assistance

We have limited funds available to assist delegates whose attendance is made difficult by a lack of financial resources at their home institutions. These funds are allocated on a competitive basis, with priority given to students and delegates from countries with a weak currency or under-represented groups of the astronomical community. The deadline for applications for financial assistance is 29 February 2008. Note that your chances are greatly increased if you also submit a proposed contribution accompanied by a strong abstract by that (early) deadline. Students are requested to ask their thesis director to e-mail a letter of support to us.

Travel

Keele is located in the United Kingdom between Manchester and Birmingham, in a rural setting on a hilltop a few kilometers outside the towns of Newcastle-under-Lyme and Stoke-on-Trent (famous for its Potteries, such as Wedgwood, Doulton and Spode). There are good rail connections from Manchester and Birmingham to Stoke-on-Trent (Crewe is somewhat further). Manchester Airport is the nearest to Keele and has many intercontinental connections (directly or via London or other European airports). Liverpool Airport and the London airports are progressively less convenient alternatives.

Proceedings

All registered attendees receive a complementary copy of the conference proceedings. These will be published by Cambridge University Press.

Style files and macros, as well as information about the page allocations will be made available before the start of the symposium.

The deadline for submitting manuscripts is 30 September 2008. We must adhere strictly to this deadline, to ensure a timely publication.

Cultural events

To relax after the scientific sessions, why not enjoy the programme of cultural events we have put together?

On Sunday evening, you are cordially invited to a complimentary welcome cocktail at the historical Keele Hall, which is situated in beautifully landscaped gardens on the university campus.

On Monday evening, we host an open air performance of one of Shakespeare’s greatest works, ‘Othello’, in the gardens of Keele Hall, by Anvil Productions. This is bound to be exceedingly good theatre, and a lot of fun. Tickets can be purchased upon registration for the conference at £12.50, which includes a guaranteed seat if purchased by 30 April 2008 (thereafter, a seat cannot be guaranteed and you may need to lounge on the lawn instead).

On Tuesday evening, there will be a public lecture on Archaeoastronomy, by Professor Clive Ruggles. Although free of charge, this promises to be an exciting presentation drawing a large audience from the general public, and we therefore urge you to reserve a ticket in advance (using the registration form).

On Wednesday evening, we host a classical concert to be performed in the University Chapel by the acclaimed en-

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semble London Concertante. The programme is put together exclusively for the symposium, and will include pieces by Herschel, Bach, Mozart and Vivaldi. This event is open to the public, and we therefore recommend you purchase your ticket(s) upon registration for the conference. Tickets are £12.50.

On Thursday evening will be the conference dinner, hosted in a beautiful 16th century country manor house in south Cheshire, Wrenbury Hall. The costs for this three-course dinner are £40 per person and include a welcome cocktail and transport.

Important dates

- 29 February 2008 Submission deadline for financial assistance requests
- March 2008 Registration and payment form goes live
- 31 March 2008 Submission deadline for proposed contributions
- 30 April 2008 Deadline for early registration
- 18 July 2008 Final deadline for registration
- 28 July - 1 August 2008 IAU Symposium 256 takes place at Keele
- 30 September 2008 Deadline for submission of proceedings manuscripts

We look forward to meeting you at Keele this Summer!

Jacco van Loon and Nye Evans, on behalf of the SOC and LOC

See also http://www.astro.keele.ac.uk/iaus256