Figure 1: The massive O-star cluster NGC 346 in the SMC, imaged by Stephen Chadwick from Himatangi Beach, New Zealand, using a 10" (25 cm) f/8 Vixen VMC260 L through Hα (red), [O III] (green) and Hβ (blue) filters.
Editorial

Dear Colleagues,

It is my pleasure to present you the 121st issue of the Magellanic Clouds Newsletter. It features the long-awaited third epoch of proper motion measurements of the Magellanic Clouds with the Hubble Space Telescope, and other papers dealing with the structure of the Magellanic System, the cycle and composition of dust and the formation of molecular clouds in a bubbly interstellar medium, the initial mass function and multiple-population massive star clusters, binaries and other sources of X-ray emission, as well as considering galaxy satellite pairs in a more general context. Enjoy!

The next issue is planned to be distributed on the 1st of April, 2013.

Editorially Yours,
Jacco van Loon

Supergiant shells and molecular cloud formation in the LMC

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We investigate the influence of large-scale stellar feedback on the formation of molecular clouds in the Large Magellanic Cloud (LMC). Examining the relationship between H\textsubscript{I} and $^{12}$CO(J=1–0) in supergiant shells (SGSs), we find that the molecular fraction in the total volume occupied by SGSs is not enhanced with respect to the rest of the LMC disk. However, the majority of objects ($\sim$ 70\% by mass) are more molecular than their local surroundings, implying that the presence of a supergiant shell does on average have a positive effect on the molecular gas fraction. Averaged over the full SGS sample, our results suggest that $\sim$ 12–25\% of the molecular mass in supergiant shell systems was formed as a direct result of the stellar feedback that created the shells. This corresponds to $\sim$ 4–11\% of the total molecular mass of the galaxy. These figures are an approximate lower limit to the total contribution of stellar feedback to molecular cloud formation in the LMC, and constitute one of the first quantitative measurements of feedback-triggered molecular cloud formation in a galactic system.

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On the metallicity dependence of classical Cepheid light amplitudes

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Classical Cepheids remain a cornerstone of the cosmic distance scale, and thus characterizing the dependence of
their light amplitude on metallicity is important. Period-amplitude diagrams constructed for longer-period classical Cepheids in IC1613, NGC3109, SMC, NGC6822, LMC, and the Milky Way imply that very metal-poor Cepheids typically exhibit smaller V-band amplitudes than their metal-rich counterparts. The results provide an alternate interpretation relative to arguments for a null and converse metallicity dependence. The empirical results can be employed to check predictions from theoretical models, to approximate mean abundances for target populations hosting numerous long-period Cepheids, and to facilitate the identification of potentially blended or peculiar objects.

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An X-ray and optical light curve model of the eclipsing symbiotic binary SMC 3
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Some binary evolution scenarios to Type Ia supernovæ include long-period binaries that evolve to symbiotic supersoft X-ray sources in their late stage of evolution. However, symbiotic stars with steady hydrogen burning on the white dwarf’s (WD) surface are very rare, and the X-ray characteristics are not well known. SMC 3 is one such rare example and a key object for understanding the evolution of symbiotic stars to Type Ia supernovæ. SMC 3 is an eclipsing symbiotic binary, consisting of a massive WD and red giant (RG), with an orbital period of 4.5 years in the Small Magellanic Cloud. The long-term V light curve variations are reproduced as orbital variations in the irradiated RG, whose atmosphere fills its Roche lobe, thus supporting the idea that the RG supplies matter to the WD at rates high enough to maintain steady hydrogen burning on the WD. We also present an eclipse model in which an X-ray emitting region around the WD is almost totally occulted by the RG swelling over the Roche lobe on the trailing side, although it is always partly obscured by a long spiral tail of neutral hydrogen surrounding the binary in the orbital plane.

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The initial mass function of field OB stars in the Small Magellanic Cloud
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Some theories of star formation suggest massive stars may only form in clustered environments, which would create a deficit of massive stars in low density environments. Observationally, Massey (2002) finds such a deficit in samples of the field population in the Small and Large Magellanic Clouds, with an IMF slope of $\Gamma \sim 4$. These IMF measurements represent some of the largest known deviations from the standard Salpeter IMF slope of $\Gamma = 1.35$. Here, we carry out a comprehensive investigation of the mass function above 20 $M_\odot$ for the entire field population of the Small Magellanic Cloud, based on data from the Runaways and Isolated O Type Star Spectroscopic Survey of the SMC (RIOTS4). This is a spatially complete census of the entire field OB star population of the SMC obtained with the IMACS multi-object spectrograph and MIKE échelle spectrograph on the Magellan telescopes. Based on Monte-Carlo simulations of the evolved present-day mass function, we find the slope of the field IMF above 20 $M_\odot$ is $\Gamma = 2.3 \pm 0.4$. We extend our IMF measurement to lower masses using BV photometry from the OGLE II survey. We use a statistical approach to generate a probability distribution for the mass of each star from the OGLE photometry, and we again find $\Gamma = 2.3 \pm 0.6$ for stellar masses from 7–20 $M_\odot$. The discovery and removal of ten runaways in our RIOTS4 sample steepens the field IMF slope to $\Gamma = 2.8 \pm 0.5$. We discuss the possible effects of binarity and star-formation history
on our results, and conclude that the steep field massive star IMF is most likely a real effect.

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Ultra-deep Hubble Space Telescope imaging of the Small Magellanic Cloud: The initial mass function of stars with $M_{\lesssim}1$ $M_\odot$

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We present a new measurement of the stellar initial mass function (IMF) based on ultra-deep, high-resolution photometry of >5,000 stars in the outskirts of the Small Magellanic Cloud (SMC) galaxy. The Hubble Space Telescope (HST) Advanced Camera for Surveys (ACS) observations reveal this rich, co-spatial population behind the foreground globular cluster 47 Tuc, which we targeted for 121 HST orbits. The stellar main sequence of the SMC is measured in the F606W, F814W color–magnitude diagram (CMD) down to $\sim 30$th magnitude, and is cleanly separated from the foreground star cluster population using proper motions. We simulate the SMC population by extracting stellar masses (single and unresolved binaries) from specific IMFs, and converting those masses to luminosities in our bandpasses. The corresponding photometry for these simulated stars is drawn directly from a rich cloud of 4 million artificial stars, thereby accounting for the real photometric scatter and completeness of the data. Over a continuous and well populated mass range of $M =$ 0.37–0.93 $M_\odot$ (i.e. down to a ~ 75% completeness limit at $F606W = 28.7$ mag), we demonstrate that the IMF is well represented by a single power-law form with slope $\alpha = -1.90^{+0.15}_{-0.10}$ (i.e. $dN/dM \propto M^{\alpha}$). This is shallower than the Salpeter slope of $\alpha = -2.35$, which agrees with the observed stellar luminosity function at higher masses. Our results indicate that the IMF does not turn over to a more shallow power-law form within this mass range. We discuss implications of this result for the theory of star formation, the inferred masses of galaxies, and the (lack of a) variation of the IMF with metallicity.

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The global gas and dust budget of the Small Magellanic Cloud

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In order to understand the evolution of the interstellar medium (ISM) of a galaxy, we have analysed the gas and dust budget of the Small Magellanic Cloud (SMC). Using the Spitzer Space Telescope, we measured the integrated gas mass-loss rate across asymptotic giant branch (AGB) stars and red supergiants (RSGs) in the SMC, and obtained a rate of $1.4 \times 10^{-3} M_\odot$ yr$^{-1}$. This is much smaller than the estimated gas ejection rate from type II supernovae (SNe) ($2-4 \times 10^{-2} M_\odot$ yr$^{-1}$). The SMC underwent an increase in star-formation rate in the last 12 Myr, and consequently the galaxy has a relatively high SN rate at present. Thus, SNe are more important gas sources than AGB stars in the SMC. The total gas input from stellar sources into the ISM is $2-4 \times 10^{-2} M_\odot$ yr$^{-1}$. This is slightly smaller than the ISM gas consumed by star formation ($\sim 8 \times 10^{-2} M_\odot$ yr$^{-1}$). Star formation in the SMC relies on a gas reservoir in the ISM, but eventually the star-formation rate will decline in this galaxy, unless gas infalls into the ISM from an
external source. The dust injection rate from AGB and RSG candidates is $1 \times 10^{-5} \, M_\odot \, yr^{-1}$. Dust injection from SNe is in the range of $0.2 - 11 \times 10^{-4} \, M_\odot \, yr^{-1}$, although the SN contribution is rather uncertain. Stellar sources could be important for ISM dust ($3 \times 10^{-5} \, M_\odot \, yr^{-1}$) in the SMC, if the dust lifetime is about 1.4 Gyr. We found that the presence of poly-aromatic hydrocarbons (PAHs) in the ISM cannot be explained entirely by carbon-rich AGB stars. Carbon-rich AGB stars could inject only $7 \times 10^{-9} \, M_\odot \, yr^{-1}$ of PAHs at most, which could contribute up to 100 $M_\odot$ of PAHs in the lifetime of a PAH. The estimated PAH mass of 1800 $M_\odot$ in the SMC can not be explained. Additional PAH sources, or ISM reprocessing should be needed.

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The contribution of thermally-pulsing asymptotic giant branch and red supergiant stars to the luminosities of the Magellanic Clouds at 1–24 $\mu$m

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We present the near- through mid-infrared flux contribution of thermally-pulsing asymptotic giant branch (TP-AGB) and massive red supergiant (RSG) stars to the luminosities of the Large and Small Magellanic Clouds (LMC and SMC, respectively). Combined, the peak contribution from these cool evolved stars occurs at $\sim 3 - 4 \, \mu$m, where they produce 32% of the SMC light, and 25% of the LMC flux. The TP-AGB star contribution also peaks at $\sim 3 - 4 \, \mu$m and amounts to 21% in both galaxies. The contribution from RSG stars peaks at shorter wavelengths, 2.2 $\mu$m, where they provide 11% of the SMC flux, and 7% for the LMC. Both TP-AGB and RSG stars are short lived, and thus potentially impose a large stochastic scatter on the near-IR derived mass-to-light ratios of galaxies at rest-frame 1–4 $\mu$m. To minimize their impact on stellar mass estimates, one can use the M/L ratio at shorter wavelengths (e.g., at 0.8–1 $\mu$m). At longer wavelengths ($\geq 8 \, \mu$m), emission from dust in the interstellar medium dominates the flux. In the LMC, which shows strong PAH emission at 8 $\mu$m, TP-AGB and RSG contribute less than 4% of the 8-$\mu$m flux. However, 19% of the SMC 8-$\mu$m flux is from evolved stars, nearly half of which is produced by the rarest, dustiest, carbon-rich TP-AGB stars. Thus, star formation rates of galaxies, based on an 8-$\mu$m flux (e.g., observed-frame 24 $\mu$m at $z = 2$), may be biased modestly high, especially for galaxies with little PAH emission.

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Chandra observations of SN 1987A: the soft X-ray light curve revisited

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We report on the present stage of SN 1987A as observed by the Chandra X-ray Observatory. We re-analyse published Chandra observations and add three more epochs of Chandra data to get a consistent picture of the evolution of the X-ray fluxes in several energy bands. We discuss the implications of several calibration issues for Chandra data. Using
the most recent Chandra calibration files, we find that the 0.5–2.0 keV band fluxes of SN 1987A have increased by
\( \sim 6 \times 10^{-13} \text{ erg s}^{-1} \text{ cm}^{-2} \) per year since 2009. This is in contrast with our previous result that the 0.5–2.0 keV light
curve showed a sudden flattening in 2009. Based on our new analysis, we conclude that the forward shock is still in
full interaction with the equatorial ring.

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Galaxy pairs in the Local Group
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Current models of galaxy formation predict that galaxy pairs of comparable magnitudes should become increasingly
rare with decreasing luminosity. This seems at odds with the relatively high frequency of pairings among dwarf galaxies
in the Local Group. We use literature data to show that \( \sim 30\% \) of all satellites of the Milky Way and Andromeda
galaxies brighter than \( M_V = -8 \) mag are found in likely physical pairs of comparable luminosity. Besides the well-
known pairings of the Magellanic Clouds and of NGC 147/NGC 185, other candidate pairs include the Ursa Minor and
Draco dwarf spheroidals, as well as the And I/And III satellites of M 31. These pairs are much closer than expected
by chance if the radial and angular distributions of satellites were uncorrelated; in addition, they have very similar
line-of-sight velocities and luminosities that differ by less than three magnitudes. In contrast, the same criteria pair
fewer than 4\% of satellites in \( N \)-body/semi-analytic models that match the radial distribution and luminosity function
of Local Group satellites. If confirmed in studies of larger samples, the high frequency of dwarf galaxy pairings may
provide interesting clues to the formation of faint galaxies in the current cosmological paradigm.

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The VLT-FLAMES Tarantula Survey X: Evidence for a bimodal
distribution of rotational velocities for the single early B-type stars
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Context: Projected rotational velocities (\( v \sin i \)) have been estimated for 334 targets in the VLT–FLAMES Tarantula
survey that do not manifest significant radial velocity variations and are not supergiants. They have spectral types from approximately O9.5 to B3. The estimates have been analysed to infer the underlying rotational velocity distribution, which is critical for understanding the evolution of massive stars.

Methods: Projected rotational velocities were deduced from the Fourier transforms of spectral lines, with upper limits also being obtained from profile fitting. For the narrower lined stars, metal and non-diffuse helium lines were adopted, and for the broader lined stars, both non-diffuse and diffuse helium lines; the estimates obtained using the different sets of lines are in good agreement. The uncertainty in the mean estimates is typically 4% for most targets. The iterative deconvolution procedure of Lucy has been used to deduce the probability density distribution of the rotational velocities.

Results: Projected rotational velocities range up to approximately 450 km s\(^{-1}\) and show a bi-modal structure. This is also present in the inferred rotational velocity distribution with 25% of the sample having \(0 \leq v_e \leq 100\) km s\(^{-1}\) and the high velocity component having \(v_e \sim 250\) km s\(^{-1}\). There is no evidence from the spatial and radial velocity distributions of the two components that they represent either field and cluster populations or different episodes of star formation. Be-type stars have also been identified.

Conclusions: The bi-modal rotational velocity distribution in our sample resembles that found for late-B and early-A type stars. While magnetic braking appears to be a possible mechanism for producing the low-velocity component, we can not rule out alternative explanations.

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Stellar dust production and composition in the Magellanic Clouds

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The dust reservoir in the interstellar medium of a galaxy is constantly being replenished by dust formed in the stellar winds of evolved stars. Due to their vicinity, nearby irregular dwarf galaxies the Magellanic Clouds provide an opportunity to obtain a global picture of the dust production in galaxies. The Small and Large Magellanic Clouds have been mapped with the Spitzer Space Telescope from 3.6 to 160 \(\mu\)m, and these wavelengths are especially suitable to study thermal dust emission. In addition, a large number of individual evolved stars have been targeted for 5–40 \(\mu\)m spectroscopy, revealing the mineralogy of these sources. Here I present an overview on the work done on determining the total dust production rate in the Large and Small Magellanic Clouds, as well as a first attempt at revealing the global composition of the freshly produced stardust.

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RX J0123.4−7321, a Be/X-ray binary in the wing of the SMC

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To confirm faint Be/X-ray binary candidates from the XMM–Newton survey of the Small Magellanic Cloud, we searched for X-ray outbursts in archival ROSAT observations. We found that RX J0123.4−7321 was much brighter when detected with ROSAT than seen 16 years later by XMM–Newton. We analysed the ROSAT observations and the OGLE I-band light curve of the optical counterpart to investigate the nature of the system. High long-term variability in the X-ray flux of a factor of \(\sim 150\) was found between the ROSAT and XMM–Newton detections, indicating strong outburst activity during the ROSAT observations. The I-band light curve reveals long-term variability and regular
outbursts with a period of \((119.9 \pm 2.5)\) days indicating the orbital period of the binary system. The large X-ray flux variations and the properties of the optical counterpart confirm RX J0123.4−7321 as a new Be/X-ray binary in the wing of the Small Magellanic Cloud.

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A new extended main sequence turnoff star cluster in the Large Magellanic Cloud

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We present results on the age and metallicity estimates of the poorly studied LMC cluster SL 529, from CCD SDSS \(gr\) photometry obtained at the Gemini South telescope with the GMOS attached. The cluster MSTO region possesses an extended structure, with an age spread (\(\sim 0.5\) Gyr) bigger than the mean age width of known EMSTO LMC clusters. We report for the first time a mean cluster age of 2.25 Gyr and a mean cluster metallicity of \(Z = 0.004\), which place it as the most metal-poor and oldest cluster in the EMSTO LMC cluster group. In addition, the cluster RC appears to be formed by two concentrations of stars – although it is not clear whether this feature can be caused, in part, by binary interactions and mergers – whereas the cluster core radius of 4.2 pc is in excellent agreement with those determined for the previously 12 known LMC EMSTO clusters.

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The star formation history of the Large Magellanic Cloud star clusters NGC 1846 and NGC 1783

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NGC 1846 and NGC 1783 are two massive star clusters in the Large Magellanic Cloud, hosting both an extended main sequence turn-off and a dual clump of red giants. They present similar masses but differ mainly in angular size. Starting from their high-quality ACS data in the F435W, F555W and F814W filters, and updated sets of stellar evolutionary tracks, we derive their star formation rates as a function of age, SFR(t), by means of the classical method of CMD reconstruction which is usually applied to nearby galaxies. The method confirms the extended periods of star formation derived from previous analysis of the same data. When the analysis is performed for a finer resolution in age, we find clear evidence for a 50-Myr long hiatus between the oldest peak in the SFR(t), and a second prolonged period of star formation, in both clusters. For the more compact cluster NGC 1846, there seems to be no significant difference between the SFR(t) in the cluster centre and in an annulus with radii between 20 and 60” (from 4.8 to 15.4 pc). The same does not occur in the more extended NGC 1783 cluster, where the outer ring (between 33 and 107”, from 8.0 to 25.9 pc) is found to be slightly younger than the centre. We also explore the best-fitting slope of the present-day mass function and binary fraction for the different cluster regions, finding hints of a varying mass function between centre and outer ring in NGC 1783. These findings are discussed within the present scenarios for the formation of clusters with multiple turn-offs.

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Third-epoch Magellanic Cloud proper motions I: HST/WFC3 data and orbit implications

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We present proper motions for the Large & Small Magellanic Clouds (LMC & SMC) based on three epochs of Hubble Space Telescope data, spanning a ~ 7 yr baseline, and centered on fields with background QSOs. The first two epochs, the subject of past analyses, were obtained with ACS/HRC, and have been re-analysed here. The new third epoch with WFC3/UVIS increases the time baseline and provides better control of systematics. The three-epoch data yield proper motion random errors of only 1–2% per field. For the LMC this is sufficient to constrain the internal proper motion dynamics, as will be discussed in a separate paper. Here we focus on the implied center-of-mass proper motions: \( \mu_{W,\text{LMC}} = -1.910 \pm 0.020 \) mas yr\(^{-1} \), \( \mu_{N,\text{LMC}} = 0.229 \pm 0.047 \) mas yr\(^{-1} \), and \( \mu_{W,\text{SMC}} = -0.772 \pm 0.063 \) mas yr\(^{-1} \), \( \mu_{N,\text{SMC}} = -1.117 \pm 0.061 \) mas yr\(^{-1} \). We combine the results with a revised understanding of the solar motion in the Milky Way to derive Galactocentric velocities: \( v_{\text{tot,LMC}} = 321 \pm 24 \) km s\(^{-1} \) and \( v_{\text{tot,SMC}} = 217 \pm 26 \) km s\(^{-1} \). Our proper motion uncertainties are now dominated by limitations in our understanding of the internal kinematics and geometry of the Clouds, and our velocity uncertainties are dominated by distance errors. Orbit calculations for the Clouds around the Milky Way allow a range of orbital periods, depending on the uncertain masses of the Milky Way and LMC. Periods \( \lesssim 4 \) Gyr are ruled out, which poses a challenge for traditional Magellanic Stream models. First-infall orbits are preferred (as supported by other arguments as well) if one imposes the requirement that the LMC and SMC must have been a bound pair for at least several Gyr.

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Satellites in MW-like hosts: Environment dependence and close pairs

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Previous studies showed that an estimate of the likelihood distribution of the Milky Way halo mass can be derived using the properties of the satellites similar to the Large and Small Magellanic Clouds (LMC and SMC). However, it would be straightforward to interpret such an estimate only if the properties of the Magellanic Clouds (MCs) are fairly typical and are not biased by the environment. In this study we explore whether the environment of the Milky Way affects the properties of the SMC and LMC such as their velocities. To test for the effect of the environment, we compare velocity distributions for MC-sized subhalos around Milky Way hosts in a sample selected simply by mass and in the second sample of such halos selected with additional restrictions on the distance to the nearest cluster and the local galaxy density, designed to mimic the environment of the Local Group (LG). We find that satellites in halos in the LG-like environments do have somewhat larger velocities, as compared to the halos of similar mass in the sample without environmental constraints. For example, the fraction of subhalos matching the velocity of the LMC is 23 ± 2% larger in the LG-like environments. We derive the host halo likelihood distribution for the samples in the LG-like environment and in the control sample and find that the environment does not significantly affect the derived likelihood. We use the updated properties of the SMC and LMC to derive the constraint on the MW halo mass \( \log(M_{\text{tot}}/M_\odot) = 12.06^{+0.31}_{-0.19} \) (90% confidence interval). We also explore the incidence of close pairs with relative velocities and separations similar to those of the LMC and SMC and find that such pairs are quite rare among ΛCDM halos. Only 2% of halos in the MW mass range have a relatively close pair (\( \Delta r < 40 \) kpc and \( \Delta s < 160 \) km s\(^{-1} \)) of subhalos with circular velocities \( v_{\text{circ}} > 50 \) km s\(^{-1} \). Pairs with masses and separations similar to those of the LMC and SMC (\( \Delta r_{\text{MC}} = 23.4 \pm 10 \) kpc, and \( \Delta s_{\text{MC}} = 128 \pm 32 \) km s\(^{-1} \)) are found only in one out of \( \approx 30000 \) MW-sized
Interestingly, the halo mass likelihood distribution for host halos constrained to have MC-like close pairs of subhalos is quite different from the global likelihood from which the MW halo mass constraint discussed above was derived. Taking into account the close separation of the MCs in the Busha et al. (2011) method results in the shift of the MW halo mass estimate to smaller masses, with the peak shifting approximately by a factor of two.

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Discovery of X-ray emission from young suns in the Small Magellanic Cloud


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We report the discovery of extended X-ray emission within the young star cluster NGC 602 in the Wing of the Small Magellanic Cloud (SMC) based on observations obtained with the Chandra X-ray Observatory. X-ray emission is detected from the cluster core area with the highest stellar density and from a dusty ridge surrounding the H II region. We use a census of massive stars in the cluster to demonstrate that a cluster wind or wind-blown bubble is unlikely to provide a significant contribution to the X-ray emission detected from the central area of the cluster. We therefore suggest that X-ray emission at the cluster core originates from an ensemble of low- and solar-mass pre-main-sequence (PMS) stars, each of which would be too weak in X-rays to be detected individually. We attribute the X-ray emission from the dusty ridge to the embedded tight cluster of the new-born stars known in this area from infrared studies. Assuming that the levels of X-ray activity in young stars in the low-metallicity environment of NGC 602a are comparable to their Galactic counterparts, then the detected spatial distribution, spectral properties, and level of X-ray emission are largely consistent with those expected from low- and solar-mass PMS stars and young stellar objects (YSOs). This is the first discovery of X-ray emission attributable to PMS stars and YSOs in the SMC, which suggests that the accretion and dynamo processes in young, low-mass objects in the SMC resemble those in the Galaxy.

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Did the infant R 136 and NGC 3603 clusters undergo residual gas expulsion?

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Based on kinematic data observed for very young, massive clusters that appear to be in dynamical equilibrium, it has recently been argued that such young systems set examples where the early residual gas-expulsion did not happen or had no dynamical effect. The intriguing scenario of a star cluster forming through a single starburst has thereby been challenged. Choosing the case of the R 136 cluster of the Large Magellanic Cloud, the most cited one in this context, we perform direct N-body computations that mimic the early evolution of this cluster including the gas-removal phase (on a thermal timescale). Our calculations show that under plausible initial conditions as consistent from observational data, a large fraction (> 60%) of a gas-expelled, expanding R 136-like cluster is bound to regain dynamical equilibrium by its current age. Therefore, the recent measurements of velocity dispersion in the inner regions of R 136, that indicate that the cluster is in dynamical equilibrium, are consistent with an earlier substantial gas expulsion of R 136 followed by a rapid re-virialization (in ≈ 1 Myr). Additionally, we find that the less massive Galactic NGC 3603 Young Cluster (NYC), with a substantially longer re-virialization time, is likely to be found deviated from dynamical equilibrium at its present age (≈ 1 Myr). The recently obtained stellar proper motions in the central part of the NYC indeed
suggest this and are consistent with the computed models. This work significantly extends previous models of the Orion Nebula Cluster which already demonstrated that the re-virialization time of young post-gas-expulsion clusters decreases with increasing pre-expulsion density.

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The detection of an older population in the Magellanic Bridge

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The Magellanic system comprises the Large Magellanic Cloud (LMC), the Small Magellanic Cloud (SMC), and the less frequently observed Magellanic Bridge and Magellanic Stream. The Bridge is traced by neutral gas and has an observed stellar component, while the Stream consists of gas only, with no observed stellar counterpart to date. This study uses catalogues created in the direction of the Bridge from 2MASS and WISE to investigate the stellar content of the Magellanic Bridge. Catalogues were created and colour–magnitude and two-colour diagrams were analysed. A study was also carried out on removing the Galactic foreground population in the direction of the Magellanic Bridge, which was an important consideration due to the low stellar density within the Bridge. This study finds that the Magellanic Bridge contains a candidate older stellar population in addition to the younger population already known. The formation of the Magellanic Bridge is likely to have occurred from a tidal event between the LMC and SMC drawing most of the material into it from the SMC. An older population in the Bridge indicates that a stellar content was drawn in during its formation together with a gas component.

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On the distance of the Magellanic Clouds using Cepheid NIR and optical–NIR period–Wesenheit relations

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We present the largest near-infrared (NIR) data sets, $JHK_s$, ever collected for classical Cepheids in the Magellanic Clouds (MCs). We selected fundamental (FU) and first overtone (FO) pulsators, and found 4150 (2571 FU, 1579 FO) Cepheids for Small Magellanic Cloud (SMC) and 3042 (1840 FU, 1202 FO) for Large Magellanic Cloud (LMC). Current sample is 2–3 times larger than any sample used in previous investigations with NIR photometry. We also discuss optical $VI$ photometry from OGLE-III. NIR and optical–NIR Period–Wesenheit (PW) relations are linear over the entire period range $(0.0 < \log P_{FU} \leq 1.65)$ and their slopes are, within the intrinsic dispersions, common between the MCs. These are consistent with recent results from pulsation models and observations suggesting that
the PW relations are minimally affected by the metal content. The new FU and FO PW relations were calibrated using a sample of Galactic Cepheids with distances based on trigonometric parallaxes and Cepheid pulsation models. By using FU Cepheids we found a true distance moduli of $18.45 \pm 0.02$ (random) $\pm 0.10$ (systematic) mag (LMC) and $18.93 \pm 0.02$ (random) $\pm 0.10$ (systematic) mag (SMC). These estimates are the weighted mean over 10 PW relations and the systematic errors account for uncertainties in the zero-point and in the reddening law. We found similar distances using FO Cepheids ($18.60 \pm 0.03$ (random) $\pm 0.10$ (systematic) mag [LMC] and $19.12 \pm 0.03$ (random) $\pm 0.10$ (systematic) mag [SMC]). These new MC distances lead to the relative distance, $\Delta \mu = 0.48 \pm 0.03$ mag (FU, log $P = 1$) and $\Delta \mu = 0.52 \pm 0.03$ mag (FO, log $P = 0.5$), which agrees quite well with previous estimates based on robust distance indicators.

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Conference Paper

Classical Cepheids. What else?
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We present new and independent estimates of the distances to the Magellanic Clouds (MCs) using near-infrared (NIR) and optical–NIR Period–Wesenheit (PW) relations. The slopes of the PW relations are, within the dispersion, linear over the entire period range and independent of metal content. The absolute zero points were fixed using Galactic Cepheids with distances based on the infrared surface-brightness method. The true distance modulus we found for the Large Magellanic Cloud – $(m - M)_0 = 18.48 \pm 0.01 \pm 0.10$ mag – and the Small Magellanic Cloud – $(m - M)_0 = 18.94 \pm 0.01 \pm 0.10$ mag – agree quite well with similar distance determinations based on robust distance indicators. We also briefly discuss the evolutionary and pulsation properties of MC Cepheids.

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Announcement

1st Announcement:
Resolved stellar populations in the Galactic Bulge and the Magellanic Clouds

May 6–9, 2013
La Serena, Chile
On-line registration deadline: April 1, 2013
The advent of wide-field CCD cameras on 4-meter class telescopes has provided the chance to survey vast parts of the sky to significant depths, leading to new perspectives on the formation of our Galaxy. In particular, the selection of the Cerro Tololo site in November 1962, enabled a mapping of the until then relatively inaccessible Southern skies. As we celebrate the 50th anniversary of our National Optical Astronomy Observatory in the South, there is cause to come together for stimulating scientific discussions and also a little reverie. The topics of this conference include the resolved stellar populations of the bulge of the Milky Way, the Galactic Halo, and the Magellanic Clouds. We will discuss existing observations from large scale surveys, new surveys in the works and different strategies that allow for innovative approaches to constrain Galaxy formation models. This meeting will also be a starting point to highlight the capabilities provided by wide field cameras such as DECam and how to efficiently use them in a new era of "big data" science.

Some say Tololo means "the edge of the abyss." This is fitting as CTIO was founded on and remains at the cutting edge of astronomy. Indeed, CTIO’s impact on astronomy has far surpassed its original mission to provide world class facilities to observe the southern sky. On the occasion of CTIO’s 50th birthday, it is therefore appropriate to share stories and memories of the many events (some unconventional) and exceptional characters that have helped shape CTIO. Thus, the workshop will include a program of invited talks on the scientific and cultural history of CTIO.

Invited Magellanic Cloud speakers will cover the following topics:

- The Old Stellar Populations of the Magellanic Clouds;
- Young Stellar Objects in the Large Magellanic Cloud;
- Variable Stars in the Magellanic Clouds and Galactic Center;
- Star formation and the IMF in the Magellanic Clouds.

For more information on the Symposium, please check the website.

See also http://www.ctio.noao.edu/noao/conference/CTIO-50-years