# $\mathcal{SCYON}$

## *The Star Clusters Young & Old Newsletter*

edited by Holger Baumgardt, Ernst Paunzen and Pavel Kroupa

SCYON can be found at URL:
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## EDITORIAL

Here is the 34th issue of the SCYON newsletter. The current issue contains 35 abstracts from refereed journals, and an announcement for the MODEST-8 meeting in Bonn in December. The next issue will be sent out in September. We wish everybody a productive summer...

Thank you to all those who sent in their contributions.

Holger Baumgardt, Ernst Paunzen and Pavel Kroupa

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# SCYON POLICY

The SCYON Newsletter publishes abstracts from any area in astronomy which are relevant to research on star clusters. We welcome all contributions. Topics to be covered include

1. Abstracts from refereed articles
2. Abstracts from conference proceedings
3. PhD summaries
4. General announcements : Conferences, new databases, and the likes.

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SCYON will be published initially once every two months. If the number of contributions justifies monthly installments, we will move toward more frequent issues in order to keep the newsletter relatively short, manageable for us, and up-to-date.

Conference and journal abstracts can be submitted at any time either by web download, or failing this, we also accept abstracts typeset using the latest latex abstract template (available from the SCYON webpage). We much prefer contributors to use the direct download form, since it is mostly automated. Abstracts will normally appear on the website as soon as they are submitted to us. Other contributions, such as PhD summaries, should be sent to us using the LaTeX template. *Please do not submit postscript files, nor encoded abstracts as e-mail attachments.*

All abstracts/contributions will be processed, but we reserve the right to not post abstracts submitted in the wrong format or which do not compile. If you experience any sort of problems accessing the web site, or with the LaTeX template, please write to us at scyon@astro.u-strasbg.fr.

A "Call for abstracts" is sent out approximately one week before the next issue of the newsletter is finalised. This call contains the deadline for abstract submissions for that coming issue and the LaTeX abstract template.

Depending on circumstances, the editors might actively solicit contributions, usually those spotted on a preprint server, but they do not publish abstracts without the author's consent.

We implicitly encourage further dissemination of the letter to institutes and astronomers who may benefit from it.

The editors

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# SCYON Mirrors

The official Scyon mirror site in Australia is hosted at the Centre for Astrophysics & Supercomputing of the University of Swinburne by Duncan Forbes and his team :

HTTP://ASTRONOMY.SWIN.EDU.AU/SCYON/)

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# 1. Star Forming Regions

## Star formation in young star cluster NGC 1893

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We present a comprehensive multi-wavelength study of the star-forming region NGC 1893 to explore the effects of massive stars on low-mass star formation. Using near-infrared colours, slitless spectroscopy and narrow-band $H\alpha$ photometry in the cluster region we have identified candidate young stellar objects (YSOs) distributed in a pattern from the cluster to one of the nearby nebulae Sim 129. The $V, (V-I)$ colour-magnitude diagram of the YSOs indicates that majority of these objects have ages between 1 to 5 Myr. The spread in the ages of the YSOs may indicate a non-coeval star formation in the cluster. The slope of the KLF for the cluster is estimated to be $0.34 \pm 0.07$, which agrees well with the average value ($\sim 0.4$) reported for young clusters. For the entire observed mass range $0.6 < M/M_{\odot} \leq 17.7$ the value of the slope of the initial mass function, 'Γ', comes out to be $-1.27 \pm 0.08$, which is in agreement with the Salpeter value of -1.35 in the solar neighborhood. However, the value of 'Γ' for PMS phase stars (mass range $0.6 < M/M_{\odot} \leq 2.0$) is found to be $-0.88 \pm 0.09$ which is shallower than the value ($-1.71 \pm 0.20$) obtained for MS stars having mass range $2.5 < M/M_{\odot} \leq 17.7$ indicating a break in the slope of the mass function at $\sim 2M_{\odot}$. Estimated 'Γ' values indicate an effect of mass segregation for main-sequence stars, in the sense that massive stars are preferentially located towards the cluster center. The estimated dynamical evolution time is found to be greater than the age of the cluster, therefore the observed mass segregation in the cluster may be the imprint of the star formation process. There is evidence for triggered star formation in the region, which seems to govern initial morphology of the cluster.

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# Near-Infrared Polarimetry of the Eagle Nebula (M16)

**Koji Sugitani[1], Makoto Watanabe[2], Motohide Tamura[3], Ryo Kandori[3], J. H. Hough[4], Shogo Nishiyama[3], Yasushi Nakajima[3], Nobuhiko Kusakabe[5], Jun Hashimoto[1,6], Takahiro Nagayama[7], Chie Nagashima[8], Daisuke Kato[8], and Naoya Fukuda[9]**

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We carried out deep and wide (about 8' x 8') JHKs imaging polarimetry in the southern region of the Eagle Nebula (M16). The polarization intensity map reveals that two YSOs with near-IR reflection nebulae are located at the tips of two famous molecular pillars (Pillars 1 and 2) facing toward the exciting stars of M16. The centrosymmetric polarization pattern are consistent with those around class I objects having circumstellar envelopes, confirming that star formation is now taking place at the two tips of the pillars under the influence of UV radiation from the exciting stars. Polarization measurements of point sources show that magnetic fields are aligned along some of the pillars but in a direction that is quite different to the global structure in M16.

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# IRAS 18511+0146: a proto Herbig Ae/Be cluster?

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Context: The evolution of a young protocluster depends on the relative spatial distribution and dynamics of both stars and gas. Aims: We study the distribution and properties of the gas and stars surrounding the luminous ($10^4$ $L_\odot$) protocluster IRAS 18511+0146.
Methods: IRAS 18511+0146 and the cluster associated with it has been investigated using the sub-millimetre (JCMT-SCUBA), infrared (Spitzer-MIPSGAL, Spitzer-GLIMPSE, Palomar) and radio (VLA) continuum data. Cluster simulations have been carried out in order to understand the properties of clusters as well as to compare with the observations.
Results: The central most obscured part of the protocluster coincident with the compact sub-millimetre source found with SCUBA is responsible for at least 2/3 of the total luminosity. A number of cluster members have been identified which are bright in mid infrared and show rising (near to mid infrared) spectral energy distributions suggesting that these are very young stellar sources. In the mid infrared 8.0 micron image, a number of filamentary structures and clumps are detected in the vicinity of IRAS 18511+0146.
Conclusions: Based on the luminosity and cluster size as well as on the evolutionary stages of the cluster members, IRAS 18511+0146 is likely to be protocluster with the most massive object being a precursor to a Herbig type star.

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# 2. Galactic Open Clusters

## $uvby - H_\beta$ CCD photometry and membership segregation of the open cluster NGC 2682 (M 67).

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Following deep astrometric and photometric study of the cluster NGC2682 (M67), we are able to accurately determine its fundamental parameters. Being an old and rich cluster, M67 is a relevant object for the analysis of the Galactic disk evolution. M67 is well studied but the lack of a wide and deep Stromgren photometric study makes our results worthwhile. The brightest stars of the open cluster M67 were used as uvby-Hbeta standard stars in our studies of NGC1817 and NGC2548, and the extension of the field covered, as well as the amount of observations, allowed to obtain the best set of Stromgren data ever published for this cluster. We discuss the results of our CCD uvby-Hbeta intermediate-band photometry, covering an area of about 50'x50' down to V 19. Moreover, a complete membership segregation based on astrometric and photometric criteria is obtained. The photometric analysis of a selected sample of stars yields a reddening value of E(b-y)= 0.03±0.03, a distance modulus of $V_0 - M_V = 9.7 \pm 0.2$ and [Fe/H]= $0.01 \pm 0.14$. Through isochrone fitting we found an age of log t= $9.6 \pm 0.1$ ($4.2 \pm 0.2$ Gyr). A clump of approximately 60 stars around V= 16, (b-y)= 0.4 could be interpreted as a population of pre-cataclysmic variable stars (if members), or as a stream of field G-type stars placed at twice the distance of the cluster (if non-members).

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# Multisite campaign on the open cluster M67. III. Delta Scuti pulsations in the blue stragglers

**Bruntt, H. et al.**
University of Sydney

We have made an asteroseismic analysis of the variable blue stragglers in the open cluster M67. The data set consists of photometric time series from eight sites using nine 0.6-2.1 meter telescopes with a time baseline of 43 days. In two stars, EW Cnc and EX Cnc, we detect the highest number of frequencies (41 and 26) detected in Delta Scuti stars belonging to a stellar cluster, and EW Cnc has the second highest number of frequencies detected in any Delta Scuti star. We have computed a grid of pulsation models that take the effects of rotation into account. The distribution of observed and theoretical frequencies show that in a wide frequency range a significant fraction of the radial and non-radial low-degree modes are excited to detectable amplitudes. Despite the large number of observed frequencies we cannot constrain the fundamental parameters of the stars. To make progress we need to identify the degrees of some of the modes either from multi-colour photometry or spectroscopy.

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# The chemical abundance of the very metal rich old Open Clusters NGC 6253 and NGC 6791

**Eugenio Carretta ([1]), Angela Bragaglia ([1]), Raffaele Gratton ([2])**
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In the framework of a project aiming at deriving in a homogeneous way the properties (age, distance, reddening and detailed chemical abundances) of a large sample of old open clusters, we present here the metal abundance and the abundance ratios of light (C, N, O, Na, Mg, Al, Si, Ca, Ti) and heavier (Cr, Mn, Ni, Ba, Eu) elements in the galactic open clusters NGC 6253 and NGC 6791. We performed spectrum synthesis of selected lines on high resolution spectra of four red clump stars in NGC 6253, taken with the UVES and FEROS spectrographs. We also determined abundances of the same elements for four red clump stars in NGC 6791, observed with SARG, for which we had derived the atmospheric parameters and the iron, carbon and oxygen abundances in a previous paper (Gratton et al. 2006). The average metallicity of NGC 6253 is [Fe/H]=+0.46 (rms = 0.03 dex, systematic error = 0.08 dex), obtained by extensive spectral synthesis of Fe lines. This intermediate age cluster closely resembles the old open cluster NGC 6791, as far as the chemical composition is concerned. C, N, O do not show any significant abundance scatter; they are underabundant with respect to the solar values both in NGC 6253 and NGC 6791. We also find no evident star-to-star scatter in any of the elements measured in both clusters, with the possible exception of Na in NGC 6791. The two clusters show very similar abundances, except for Mg, overabundant in NGC 6791 and not in NGC 6253. Both have solar scaled alpha-elements abundances. We have compared our abundance ratios with literature values for disk giants and dwarfs and bulge giants, finding a general good agreement with the run of elemental ratios with [Fe/H] of disk objects.

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# Planets around evolved intermediate-mass stars. I. Two substellar companions in the open clusters NGC 2423 and NGC 4349

**C. Lovis and M. Mayor**
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Context. Many efforts are being made to characterize extrasolar planetary systems and unveil the fundamental mechanisms of planet formation. An important aspect of the problem, which remains largely unknown, is to understand how the planet formation process depends on the mass of the parent star. In particular, as most planets discovered to date orbit a solar-mass primary, little is known about planet formation around more massive stars. Aims. To investigate this point, we present first results from a radial velocity planet search around red giants in the clump of intermediate-age open clusters. We choose clusters harbouring red giants with masses between 1.5 and 4 M(sun), using the well-known cluster parameters to accurately determine the stellar masses. We are therefore exploring a poorly-known domain of primary masses, which will bring new insights into the properties of extrasolar planetary systems. Methods. We are following a sample of about 115 red giants with the Coralie and HARPS spectrographs to obtain high-precision radial velocity (RV) measurements and detect giant planets around these stars. We use bisector and activity index diagnostics to distinguish between planetary-induced RV variations and stellar photospheric jitter. Results. We present the discoveries of a giant planet and a brown dwarf in the open clusters NGC 2423 and NGC 4349, orbiting the 2.4-M(sun) star NGC 2423 No3 (TYC 5409-2156-1) and the 3.9-M(sun) star NGC 4349 No127 (TYC 8975-2606-1). These low-mass companions have orbital periods of 714 and 678 days and minimum masses of 10.6 and 19.8 M(jup), respectively. Combined with the other known planetary systems, these detections indicate that the frequency of massive planets is higher around intermediate-mass stars, and therefore probably scales with the mass of the protoplanetary disk.

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# Mass segregation in very young open clusters – A case study of NGC 2244 and NGC 6530

**L.Chen,R.de Grijs and J.L.Zhao**

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We derive the proper motions, membership probabilities, and velocity dispersions of stars in the regions of the young (2-4 Myr- old) open clusters NGC 2244 (the central cluster in the Monoceros R2 association) and NGC 6530 (the dominant cluster in the Sgr OB1 association) from photographic plate material obtained at Shanghai Astronomical Observatory, with time baselines of 34 and 87 years, respectively. Both clusters show clear evidence of mass segregation, but they do not exhibit any significant velocity-mass (or,equivalently, a velocity-luminosity) dependence. This provides strong support for the suggestion that the observed mass segregation is – at least partially – due to the way in which star formation has proceeded in these complex star-forming regions ("primordial" mass segregation). Based on arguments related to the clusters' published initial mass functions, in conjunction with our new measurements of their internal velocity dispersions (35 and 8 km/s for NGC2244 and NGC 6530, respectively), we provide strong arguments in favor of the dissolution of NGC 2244 on very short timescales,while we speculate that NGC 6530 may be more stable against the effects of internal two-body relaxation. However, this latter object may well be destroyed by the strong tidal field prevalent at its location in the Galactic plane in the direction of the Galactic Center.

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# Variable stars in the open cluster NGC 6791 and its surrounding field

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Aims: This work presents a high-precision variability survey in the field of the old, super metal-rich open cluster NGC 6791. Methods: The data sample consists of more than 75,000 high-precision CCD time series measurements in the V band obtained mainly at the Canada-France-Hawaii Telescope, with additional data from S. Pedro Martir and Loiano observatories, over a time span of ten nights. The field covers an area of 42x28 arcmin$^2$.
Results: We have discovered 260 new variables and re-determined periods and amplitudes of 70 known variable stars. By means of a photometric evaluation of the membership in NGC 6791, and a preliminary membership based on the proper motions, we give a full description of the variable content of the cluster and surrounding field in the range $16< V <23.5$. Accurate periods can be given for the variables with P$<$ 4.0 d, while for ones with longer periods the limited time-baseline hampered precise determinations. We categorized the entire sample as follows: 6 pulsating, 3 irregular, 3 cataclysmic, 89 rotational variables and 61 eclipsing systems; moreover, we detected 168 candidate variables for which we cannot give a variability class since their periods are much longer than our time baseline.
Conclusions: On the basis of photometric considerations, and of the positions of the stars with respect to the center of the cluster, we inferred that 11 new variable stars are likely members of the cluster, for 22 stars the membership is doubtful and 137 are likely non-members. We also detected an outburst of about 3 mag in the light curve of a very faint blue star belonging to the cluster and we suggest that this star could be a new U Gem (dwarf nova) cataclysmic variable.

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# The lower mass function of the young open cluster Blanco 1: from $30M_{Jup}$ to $3M_{\odot}$

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We performed a deep wide field optical survey of the young ($\sim 100 - 150$ Myr) open cluster Blanco 1 to study its low mass population well down into the brown dwarf regime and estimate its mass function over the whole cluster mass range. The survey covers 2.3 square degrees in the $I$ and $z$-bands down to $I \simeq z \simeq 24$ with the CFH12K camera. Considering two different cluster ages (100 and 150 Myr), we selected cluster member candidates on the basis of their location in the $(I, I-z)$ CMD relative to the isochrones, and estimated the contamination by foreground late-type field dwarfs using statistical arguments, infrared photometry and low-resolution optical spectroscopy. We find that our survey should contain about 57% of the cluster members in the $0.03 - 0.6M_{\odot}$ mass range, including 30-40 brown dwarfs. The candidate's radial distribution presents evidence that mass segregation has already occured in the cluster. We took it into account to estimate the cluster mass function across the stellar/substellar boundary. We find that, between $0.03M_{\odot}$ and $0.6M_{\odot}$, the cluster mass distribution does not depend much on its exact age, and is well represented by a single power-law, with an index $\alpha = 0.69 \pm 0.15$. Over the whole mass domain, from $0.03M_{\odot}$ to $3M_{\odot}$, the mass function is better fitted by a log-normal function with $m_0 = 0.36 \pm 0.07M_{\odot}$ and $\sigma = 0.58 \pm 0.06$. Comparison between the Blanco 1 mass function, other young open clusters' MF, and the galactic disc MF suggests that the IMF, from the substellar domain to the higher mass part, does not depend much on initial conditions. We discuss the implications of this result on theories developed to date to explain the origin of the mass distribution.

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# Stellar Contents of Two Intermediate Age Clusters: NGC 1912 and NGC 1907

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We present deep CCD photometry in a wide field around two open clusters NGC 1912 and NGC 1907. Stellar surface density profile indicates that the radius of the cluster NGC 1912 and NGC 1907 is $\sim 14$ arcmin and $\sim 6$ arcmin respectively. The core of the cluster NGC 1907 is found to be $1.6 \pm 0.3$ arcmin, whereas the core of the cluster NGC 1912 could not be defined due to its significant variation with the limiting magnitude. The colour-colour diagrams indicate a mean uniform reddening $E(B-V) = 0.25 \pm 0.05$ mag and $0.50 \pm 0.05$ mag across the clusters NGC 1912 and NGC 1907 respectively. The age of the clusters is found to be $\sim 300$ Myr. The clusters are situated at distance of $1400 \pm 70$ pc (NGC 1912) and $1780 \pm 80$ pc (NGC 1907), indicating that these clusters may be formed in different parts of the Galaxy. The mass function slope is derived by applying corrections of field star contamination and data incompleteness. The derived mass function for the cluster is qu! ite noisy, however in the given mass range the slope of the mass function for the clusters NGC 1912 and NGC 1907 comes out to be $-1.12 \pm 0.30$ and $-1.23 \pm 0.21$ respectively which is in agreement with the Salpeter value. The age of the clusters is much higher than the estimated relaxation time-scale, therefore dynamical relaxation may be one of the reasons for the observed mass segregation in the clusters. A comparison of the observed CMDs of the clusters with the synthetic CMDs gives a photometric binary content as $30 \pm 10\%$ (mass range $1.0 \leq M_{\odot} \leq 3.1$) and $20 \pm 10\%$ (mass range $1.2 \leq M_{\odot} \leq 3.2$) in the case of NGC 1912 and NGC 1907 respectively.

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# Tracing mixing in stars: new beryllium observations of the open clusters NGC 2516, Hyades, and M67

**S. Randich ([1]), F. Primas ([2]), L. Pasquini ([2]), P. Sestito ([1]), R. Pallavicini ([3])**
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Determinations of beryllium abundance in stars, together with lithium, provide a key tool to investigate the so far poorly understood extra-mixing processes at work in stellar interiors. We measured Be in three open clusters, complementing existing Be surveys, and aiming at gathering a more complete empirical scenario of the evolution of Be as a function of stellar age and temperature. Specifically, we analyzed VLT/UVES spectra of members of NGC 2516, the Hyades, and M 67 to determine their Be and Li abundances. In the first two clusters we focused on stars cooler than 5400 K, while the M 67 sample includes stars warmer than 6150 K, as well as two subgiants and two blue stragglers. We also computed the evolution of Be for a 0.9 Mo star based on standard evolutionary models. We find different emprical behaviours for stars in different temperature bins and ages. Stars warmer than 6150 K show Be depletion and follow a Be vs. Li correlation, while Be is undepleted in stars in the ∼6150-5600 K range. NGC 2516 members cooler than 5400 K have not depleted any Be, while older Hyades of similar temperature do show some depletion. Finally, Be is severely depleted in the subgiants and blue stragglers. The results for warm stars are in agreement with previous studies, supporting the hypothesis that mixing in this temperature regime is driven by rotation. The same holds for the two subgiants that have evolved from the "Li gap". This mechanism is instead not the dominant one for solar-type stars. Be depletion of cool Hyades cannot simply be explained by the effect of increasing depth of the convective zone. Finally, the different Be content of the two blue stragglers suggests that they have formed by two different processes (i.e., collisions vs. binary merging).

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# The anticenter old open cluster NGC 1883: radial velocity and metallicity

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Universita' di Padova Universidad de La Plata

Having already reported on the first photometric study of the intermediate-age open cluster NGC 1883 (Carraro et al. 2003), we present in this paper the first spectroscopic multi-epoch investigation of a sample of evolved stars in the same cluster. The aim is to derive the cluster membership, velocity and metallicity, and discuss recent claims in the literature (Tadross 2005) that NGC 1883 would be as metal poor as globular clusters in the Halo. Besides, being one of the few outer Galactic disk old open clusters known so far, it is an ideal target to improve our knowlwdge of the Galactic disk radial abundance gradient, that is a basic ingredient for any chemical evolution model of the Milky Way. The new data we obtained allow us to put NGC 1883 basic parameter on a firmer pace. We find that the cluster has a mean metallicity [Fe/H] = -0.20±0.22, from which we infer an age ($650^{+70}_{-70}$ Myr) close to the Hyades one and a Galactocentric distance of $12.3^{+0.4}_{-0.2}$ kpc. The metal abundance, kinematics, and position make NGC 1883 a genuine outer disk old open cluster. A time more, we confirm that in the outer Galactic disk the abundance gradient is shallower than in the solar vicinity.

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# 3. Galactic Globular Clusters

## The ACS Survey of Galactic Globular Clusters. II. Stellar Evolution Tracks, Isochrones, Luminosity Functions, and Synthetic Horizontal-Branch Models

**Aaron Dotter, Brian Chaboyer, Darko Jevremovic, E. Baron, Jason Ferguson, Ata Sarajedini, Jay Anderson**

Dartmouth College University of Oklahoma Wichita State University University of Florida Rice University

The ACS Survey of Galactic Globular Clusters, an HST Treasury Project, will deliver high-quality, homogeneous photometry of 65 globular clusters. This paper introduces a new collection of stellar evolution tracks and isochrones suitable for analyzing the ACS survey data. Stellar evolution models were computed at [Fe/H]=-2.5, -2.0, -1.5, -1.0, -0.5, and 0; [alpha/Fe]=-0.2, 0, 0.2, 0.4, 0.6, and 0.8; and three initial He abundances for masses from 0.1 to 1.8 Msolar and ages from 2 to 15 Gyr. Each isochrone spans a wide range in luminosity, from MV 14 up to the tip of the red giant branch. These are complemented by a set of He-burning tracks that extend from the zero-age horizontal branch to the onset of thermal pulsations on the asymptotic giant branch. In addition, a set of computer programs are provided that make it possible to interpolate the isochrones in [Fe/H], generate luminosity functions from the isochrones, and create synthetic horizontal-branch models. The tracks and isochrones have been converted to the observational plane with two different color-Teff transformations, one synthetic and one semiempirical, in ground-based B, V, and I, and F606W and F814W for both ACS WFC and WFPC2 systems. All models and programs presented in this paper are available at the Dartmouth Stellar Evolution Database and the Multimission Archive at the Space Telescope Science Institute.

Based on observations with the NASA/ESA Hubble Space Telescope, obtained at the Space Telescope Science Institute, which is operated by AURA, Inc., under NASA contract NAS 5-26555, under program GO-10775 (PI: A. Sarajedini).

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## Constraining white-dwarf kicks in globular clusters

**Jeremy S Heyl**
UBC

The wind of an asymptotic-giant-branch stars is sufficiently strong that if it is slightly asymmetric, it can propel the star outside of the open cluster of its birth or significantly alter its trajectory through a globular cluster; therefore, if these stellar winds are asymmetric, one would expect a deficit of white dwarfs of all ages in open clusters and for young white dwarfs to be less radially concentrated than either their progenitors or older white dwarfs in globular clusters. This latter effect has recently been observed. Hence, detailed studies of the radial distribution of young white dwarfs in globular clusters could provide a unique probe of mass loss on the asymptotic giant branch and during the formation of planetary nebulae both as a function of metallicity and a limited range of stellar mass.

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# AKARI observations of circumstellar dust in the globular clusters NGC104 and NGC362

**Yoshifusa Ita ([1]), Toshihiko Tanabe ([2]), Noriyuki Matsunaga ([2]), Yoshikazu Nakada ([2]), Mikako Matsuura ([3]), Takashi Onaka ([4]), Hideo Matsuhara ([1]), Takehiko Wada ([1]), Naofumi Fujishiro ([5]), Daisuke Ishihara ([4]), Hirokazu Kataza ([1]), Woojung Kim ([1]), Toshio Matsumoto ([1]), Hiroshi Murakami ([1]), Youichi Ohyama ([1]), Fumihiko Usui ([1]), Shinki Oyabu ([1]), Itsuki Sakon ([4]), Toshinobu Takagi ([1]), Kazunori Uemizu ([1]), Munetaka Ueno ([6]), Hidenori Watarai ([7])**

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We report preliminary results of AKARI observations of two globular clusters, NGC104 and NGC362. Imaging data covering areas of about 10x10 arcmin$^2$ centered on the two clusters have been obtained with InfraRed Camera (IRC) at 2.4, 3.2, 4.1, 7.0, 9.0, 11.0, 15.0, 18.0 and 24.0 mu. We used F11/F2 and F24/F7 flux ratios as diagnostics of circumstellar dust emission. Dust emissions are mainly detected from variable stars obviously on the asymptotic giant branch, but some variable stars that reside below the tip of the first-ascending giant branch also show dust emissions. We found eight red sources with F24/F7 ratio greater than unity in NGC362. Six out of the eight have no 2MASS counterparts. However, we found no such source in NGC104.

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# The discovery of two extremely low luminosity Milky Way globular clusters

**S. Koposov ([1,2]), J. T. A. de Jong ([1]), V. Belokurov ([2]), H.-W. Rix ([1]), D.B. Zucker ([2]), N.W. Evans ([2]), G. Gilmore ([2]), M.J. Irwin ([2]), E. F. Bell ([1])**

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We report the discovery of two extremely low luminosity globular clusters in the Milky Way Halo. These objects were detected in the Sloan Digital Sky Survey Data Release 5 and confirmed with deeper imaging at the Calar Alto Observatory. The clusters, Koposov 1 and Koposov 2, are located at $\sim 40 - 50$ kpc and appear to have old stellar populations and luminosities of only $M_V \sim -1^m$. Their observed sizes of $\sim 3$ pc are well within the expected tidal limit of $\sim$10 pc at that distance. Together with Palomar 1, AM 4 and Whiting 1, these new clusters are the lowest luminosity globulars orbiting the Milky Way, with Koposov 2 the most extreme. Koposov 1 appears to lie close to distant branch of the Sagittarius stream. The half-mass relaxation times of Koposov 1 and 2 are only $\sim 70$ Myrs and $\sim 55$ Myrs respectively (two orders of magnitude shorter than the age of the stellar populations), so it would seem that they have undergone drastic mass-segregation. Since they do not appear to be very concentrated, their evaporation timescales may be as low as $\sim 0.1 t_{\rm Hubble}$. These discoveries show that the structural parameter space of globular clusters in the Milky Way halo is not yet fully explored. They also add, through their short remaining survival times, significant direct evidence for a once much larger population of globular clusters.

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# Distances of the bulge globular clusters Terzan 5, Liller 1, UKS 1 and Terzan 4 based on HST NICMOS photometry

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A large number of pulsars and X-rays sources are detected in globular clusters. To understand the structure and content of these clusters, accurate distances are required. We derive the distances of Terzan 5, Liller 1 and UKS 1 using as a reference a recent distance determination of NGC 6528, based on HST/NICMOS and NTT/SOFI infrared photometry. The distance of the metal-poor cluster Terzan 4was derived from a comparison with M92 in NICMOS bands. Distances of the metal-rich clusters are obtained by comparison of the Horizontal Branch (HB) level of the clusters, relative to the reddening line passing through the HB of NGC 6528. We use methods based on NICMOS bands and transformations to J and H magnitudes with different assumptions. Liller 1 and Terzan 4 are found to be at the central bulge distance, UKS 1 is beyond the Galactic center, while Terzan 5 is closer to the Sun than the other four clusters. The distance of Terzan 5 is of paramount importance, given the impact of its population of 21 pulsars, which is related to the high cluster density. The distance of Terzan 5 is found to be $d_{sun} = 5.5 \pm 0.9$ kpc from the Sun, thus closer to us than values given in studies of pulsars in Terzan 5. As a consequence, the higher cluster density is even more favourable for formation of the millisecond pulsars recently detected in this cluster.

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# The fraction of binary systems in the core of thirteen Galactic globular clusters

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We used deep observations collected with ACS@HST to derive the fraction of binary systems in a sample of thirteen low-density Galactic globular clusters. By analysing the color distribution of Main Sequence stars we derived the minimum fraction of binary systems required to reproduce the observed color-magnitude diagram morphologies. We found that all the analysed globular clusters contain a minimum binary fraction larger than 6% within the core radius. The estimated global fractions of binary systems range from 10% to 50% depending on the cluster. A dependence of the relative fraction of binary systems on the cluster age has been detected, suggesting that the binary disruption process within the cluster core is active and can significantly reduce the binary content in time.

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## Radial velocities of five globular clusters obtained with AAOmega

**P. Szekely, L. L. Kiss, K. Szatmary, B. Csak, G. A. Bakos, T. R. Bedding**
University of Szeged, Hungary University of Sydney, Australia

Using the recently commissioned multi-object spectrograph AAOmega on the 3.9m AAT we have obtained medium-resolution near-infrared spectra for 10,500 stars in and around five southern globular clusters. The targets were 47 Tuc, M12, M30, M55 and NGC 288. We have measured radial velocities to +/- 1 km/s with the cross correlation method and estimated metallicity, effective temperature, surface gravity and rotational velocity for each star by fitting synthetic model spectra. An analysis of the velocity maps and velocity dispersion of member stars revealed systemic rotation in four of the target clusters.

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# 4. Galactic Center Clusters

## The Origin of the Arches Stellar Cluster Mass Function

**Sami Dib ([1]), Jongsoo Kim ([1]), Mohsen Shadmehri ([2,3])**
(1) KASI, (2) DCU, (3) Ferdowsi U.

We investigate the time evolution of the mass distribution of pre-stellar cores (PSCs) and their transition to the initial stellar mass function (IMF) in the central parts of a molecular cloud (MC) under the assumption that the coalescence of cores is important. Our aim is to explain the observed shallow IMF in dense stellar clusters such as the Arches cluster. The initial distributions of PSCs at various distances from the MC center are those of gravitationally unstable cores resulting from the gravo-turbulent fragmentation of the MC. As time evolves, there is a competition between the PSCs rates of coalescence and collapse. Whenever the local rate of collapse is larger than the rate of coalescence in a given mass bin, cores are collapsed into stars. With appropriate parameters, we find that the coalescence-collapse model reproduces very well all the observed characteristics of the Arches stellar cluster IMF; Namely, the slopes at high and low mass ends and the peculiar bum! p observed at $\sim 5-6\ M_{\odot}$. Our results suggest that today's IMF of the Arches cluster is very similar to the primordial one and is prior to the dynamical effects of mass segregation becoming important.

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# 5. Extragalactic Clusters

## A detailed study of the enigmatic cluster M82F

**N. Bastian([1]), I. Konstantopoulos([1]), L.J. Smith([1,2]), G. Trancho([3,4]), M. S. Westmoquette([1]), J.S. Gallagher III([5])**

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We present a detailed study of the stellar cluster M82F, using multi-band high resolution HST imaging and deep ground based optical slit and integral field spectroscopy. Using the imaging we create colour maps of the cluster and surrounding region in order to search for substructure. We find a large amount of substructure, which we interpret as the result of differential extinction across the projected face of the cluster. With this interpretation, we are able to construct a spatially resolved extinction map across the cluster which is used to derive the intrinsic flux distribution. Fitting cluster profiles (King and EFF) to the intrinsic images we find that the cluster is 15-30% larger than previous estimates, and that no strong evidence of mass segregation in this cluster exists. Using the optical spectra, we find that the age of M82F is 60-80Myr and from its velocity conclude that the cluster is not physically associated with a large HII region that it is projected upon, both in agreement with previous studies. The reconstructed integral field maps show that that majority of the line emission comes from a nearby HII region. The spatial dependence of the line widths (implying the presence of multiple components) measured corresponds to the extinction map derived from photometry, indicating that the gas/dust clouds responsible for the extinction are also partially ionised. Even with the wealth of observations presented here, we do not find a conclusive solution to the problem of the high light-to-mass ratio previously found for this cluster and its possible top-heavy stellar IMF.

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# Hierarchical Star-Formation in M33: Fundamental properties of the star-forming regions

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Star-formation within galaxies appears on multiple scales, from spiral structure, to OB associations, to individual star clusters, and often sub-structure within these clusters. This multitude of scales calls for objective methods to find and classify star-forming regions, regardless of spatial size. To this end, we present an analysis of star-forming groups in the local group spiral galaxy M33, based on a new implementation of the Minimum Spanning Tree (MST) method. Unlike previous studies which limited themselves to a single spatial scale, we study star-forming structures from the effective resolution limit ($\sim$20 pc) to kpc scales. Once the groups are identified, we study their properties, e.g. size and luminosity distributions, and compare them with studies of young star clusters and giant molecular clouds (GMCs). We find evidence for a continuum of star-forming group sizes, which extends into the star-cluster spatial scale regime. We do not find a characteristic scale for OB associations, unlike that found in previous studies, and we suggest that the appearance of such a scale was caused by spatial resolution and selection effects. The luminosity function of the groups is found to be well represented by a power-law with an index, -2, the same as has been found for the luminosity and mass functions of young star clusters, as well as the mass function of GMCs. Additionally, the groups follow a similar mass-radius relation as GMCs. The size distribution of the groups is best described by a log-normal distribution, the peak of which is controlled by the spatial scale probed and the minimum number of sources used to define a group. We show that within a hierarchical distribution, if a scale is selected to find structure, the resulting size distribution will have a log-normal distribution. We find an abrupt drop of the number of groups outside a galactic radius of 4kpc (although individual high-mass stars are found beyond this limit! ), suggesting a change in the structure of the star-forming ISM, possibly reflected in the lack of GMCs beyond this radius. Finally, we find that the spatial distribution of HII regions, GMCs, and star-forming groups are all highly correlated.

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# An updated survey of globular clusters in M31. II. Newly discovered bright and remote clusters.

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We present the first results of a large spectroscopic survey of candidate globular clusters located in the extreme outskirts of the nearby M31 galaxy. The survey is aimed at ascertaining the nature of the selected candidates to increase the sample of confirmed M31 clusters lying more that 2 deg away from the center of the galaxy. We obtained low resolution spectra ($\lambda/\Delta\lambda \simeq 800-1300$) of 48 targets selected from the Extended Source Catalogue of 2MASS, as in Galleti et al. (2005). The observed candidates have been robustly classified according to their radial velocity and by verifying their extended/point-source nature from ground-based optical images. We have also obtained a spectrum and a radial velocity estimate for the remote M31 globular discovered by Martin et al. (2006b). Among the 48 observed candidates clusters we found: 35 background galaxies, 8 foreground Galactic stars, and 5 genuine remote globular clusters. One of them has been already identified independently by Mackey et al. (2007), their GC1; the other four are completely new discoveries: B516, B517, B518, B519. The newly discovered clusters lie at projected distance 40kpc $< R_p <$ 100 kpc from the center of M31, and have absolute integrated magnitude $-9.5 < M_V < -7.5$. For all the observed clusters we have measured the strongest Lick indices and we have obtained spectroscopic metallicity estimates. Mackey-GC1, Martin-GC1, B517 and B518 have spectra typical of old and metal poor globular clusters ([Fe/H]$< -1.3$); B519 appears old but quite metal-rich ([Fe/H]$\simeq -0.5$); B516 presents very strong Balmer absorption lines: if this is indeed a cluster it should have a relatively young age (likely $<$ 2 Gyr). The present analysis nearly doubles the number of M31 globulars at $R_p \geq 40$ kpc. At odds with the Milky Way, M31 appears to have a significant population of very bright globular clusters in its extreme outskirts.

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# Wide-Field Survey of Globular Clusters in M31. I. A Catalog of New Clusters

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We present the result of a wide-field survey of globular clusters (GCs) in M31 covering a 3deg x 3deg field centered on M31. We have searched for GCs on CCD images taken with Washington CMT1 filters at the KPNO 0.9 m telescope using the following steps: (1) inspection of morphological parameters given by the SExtractor package such as stellarity, full width at half-maximum, and ellipticity; (2) consulting the spectral types and radial velocities obtained from spectra taken with the Hydra spectrograph at the WIYN 3.5 m telescope; and (3) visual inspection of the images of each object. We have found 1164 GCs and GC candidates, of which 605 are newly found GCs and GC candidates and 559 are previously known GCs. Among the new objects there are 113 genuine GCs, 258 probable GCs, and 234 possible GCs, according to our classification criteria. Among the known objects there are 383 genuine GCs, 109 probable GCs, and 67 possible GCs. In total there are 496 genuine GCs, 367 probable GCs and 301 possible GCs. Most of these newly found GCs have T1 magnitudes of 17.5 - 19.5 mag, [$17.9 < V < 19.9$ mag assuming (C-T1) $\sim$1.5], and (C-T1) colors in the range 1 - 2.

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# Be stars and binaries in the field of the SMC open cluster NGC330 with VLT-FLAMES

**C. Martayan[1] and M. Floquet[1] and A.M. Hubert[1] and J. Gutiérrez-Soto[1,2] and J. Fabregat[2] and C. Neiner[1] and M. Mekkas[1]**

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Observations of hot stars belonging to the young cluster SMC-NGC330 and its surrounding region were obtained with the VLT-GIRAFFE facilities in MEDUSA mode. We investigated the B and Be star properties and proportions in this environment of low metallicity. We also searched for rapid variability in Be stars using photometric databases. Using spectroscopic measurements, we characterized the emission and properties of Be stars. By cross-correlation with photometric databases such as MACHO and OGLE, we searched for binaries in our sample of hot stars, as well as for short-term variability in Be stars. We report on the global characteristics of the Be star sample (131 objects). We find that the proportion of early Be stars with a large equivalent width of the H$\alpha$ emission line is higher in the SMC than in the LMC and MW. We find a slight increase in the proportion of Be stars compared to B-type stars with decreasing metallicity. We also discovered spectroscopic and photometric binaries, and for the latter we give their orbital period. We identify 13 Be stars with short-term variability. We determine their period(s) and find that 9 Be stars are multiperiodic.

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# ACS imaging of star clusters in M51. I. Identification and radius distribution

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We use *HST/ACS* observations of the spiral galaxy M51 in *F435W*, *F555W* and *F814W* to select a large sample of star clusters with accurate effective radius measurements in an area covering the complete disc of M51. We present the dataset and study the radius distribution and relations between radius, colour, arm/interarm region, galactocentric distance, mass and age. We select a sample of 7698 (*F435W*), 6846 (*F555W*) and 5024 (*F814W*) slightly resolved clusters and derive their effective radii ($R_{\rm eff}$) by fitting the spatial profiles with analytical models convolved with the point spread function. The radii of 1284 clusters are studied in detail. We find cluster radii between 0.5 and ∼10 pc, and one exceptionally large cluster candidate with $R_{\rm eff} = 21.6$ pc. The median $R_{\rm eff}$ is 2.1 pc. We find 70 clusters in our sample which have colours consistent with being old GC candidates and we find 6 new "faint fuzzy" clusters in, or projected onto, the disc of M51. The radius distribution can not be fitted with a power law similar to the one for star-forming clouds. We find an increase in $R_{\rm eff}$ with colour as well as a higher fraction of clusters with $B-V > 0.05$ in the interarm regions. We find a correlation between $R_{\rm eff}$ and galactocentric distance ($R_{\rm G}$) of the form $R_{\rm eff} \propto R_{\rm G}^{0.12\pm0.02}$, which is considerably weaker than the observed correlation for old Milky Way GCs. We find weak relations between cluster luminosity and radius: $R_{\rm eff} \propto L^{0.15\pm0.02}$ for the interarm regions and $R_{\rm eff} \propto L^{-0.11\pm0.01}$ for the spiral arm regions, but we do not observe a correlation between cluster mass and radius. The observed radius distribution indicates that shortly after the formation of the clusters from a fractal gas, the radii of the clusters have changed in a non-uniform way. We find tentative evidence suggesting that clusters in spiral arms are more compact.

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# Gemini Spectroscopic Survey of Young Star Clusters in Merging/Interacting Galaxies. I. NGC 3256 Tidal Tail Clusters

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We present Gemini optical spectroscopy of three young star clusters in the western tidal tail of NGC 3256. Compact star clusters (as opposed to dwarf galaxy candidates) in tidal tails are rare, and these three clusters are the first for which detailed quantitative spectroscopy has ever been obtained. We find that two of these clusters appear to be coeval, while the third is approximately 2 times older ($\sim$ 200 Myr vs. $\sim$ 80 Myr). All three clusters are massive (1-3$\cdot 10^5$ Msolar) and appear to be of roughly solar metallicity. In addition, the three clusters appear to be relatively large (Reff=10-20 pc), possibly reflecting weak compression at the time of formation and/or the weak influence of the tidal field of the galaxy. All three clusters have velocities consistent with the general trend of the H I velocities in the tidal tail. We conclude that if the loosely bound tail material of NGC 3256 gets stripped during future interactions of this galaxy within its group, these three clusters may become part of the intragroup medium.

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# Gemini Spectroscopic Survey of Young Star Clusters in Merging/Interacting Galaxies. II. NGC 3256 Clusters

**G. Trancho([1,2]), N. Bastian([3]), B.W. Miller([2]), F. Schweizer([4])**
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We present Gemini optical spectroscopy of 23 young star clusters in NGC3256. We find that the cluster ages range are from few Myr to ∼150 Myr. All these clusters are relatively massive (2–40)x $10^5 M_\odot$ and appear to be of roughly 1.5 solar metallicity. The majority of the clusters in our sample follow the same rotation curve as the gas and hence were presumably formed in the molecular-gas disk. However, a western subsample of five clusters has velocities that deviate significantly from the gas rotation curve. These clusters may either belong to the second spiral galaxy of the merger or may have formed in tidal-tail gas falling back into the system. We discuss our observations in light of other known cluster populations in merging galaxies, and suggest that NGC 3256 is similar to Arp 220, and hence may become an Ultra-luminous Infrared Galaxy as the merger progresses and the star-formation rate increases. Some of the clusters which appeared as isolated in our ground-based images are clearly resolved into multiple sub-components in the HST-ACS images. The same effect has been observed in the Antennae galaxies, showing that clusters are often not formed in isolation, but instead tend to form in larger groups or cluster complexes.

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# The Luminosity Distribution of Globular Clusters in Dwarf Galaxies

**Sidney van den Bergh**
Herzberg Institute of Astrophysics, National Research Council of Canada

The majority of the globular clusters associated with the Sagittarius dwarf galaxy are faint. In this respect it differs significantly from the globular cluster systems surrounding typical giant galaxies. The observation that most of globular clusters in the outer halo of the Galaxy are also sub-luminous may be understood by assuming that these clusters once also belonged to faint cluster-rich dwarf systems that were subsequently captured and destroyed by the Milky Way System.

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# 6. Dynamical evolution - Simulations

## A comprehensive set of simulations studying the influence of gas expulsion on star cluster evolution

**Holger Baumgardt & Pavel Kroupa**
AIfA, University of Bonn

We have carried out a large set of N-body simulations studying the effect of residual-gas expulsion on the survival rate and final properties of star clusters. We have varied the star formation efficiency, gas expulsion timescale and strength of the external tidal field, obtaining a three-dimensional grid of models which can be used to predict the evolution of individual star clusters or whole star cluster systems by interpolating between our runs. The complete data of these simulations is made available on the Internet.

Our simulations show that cluster sizes, bound mass fraction and velocity profile are strongly influenced by the details of the gas expulsion. Although star clusters can survive star formation efficiencies as low as 10

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## Massive stars and globular cluster formation

**Kenji Bekki & Masashi Chiba**
University of New South Wales

We first present chemodynamical simulations to investigate how stellar winds of massive stars influence early dynamical and chemical evolution of forming globular clusters (GCs). In our numerical models, GCs form in turbulent,high-density giant molecular clouds (GMCs), which are embedded in a massive dark matter halo at high redshifts. We show how high-density, compact stellar systems are formed from GMCs influenced both by physical processes associated with star formation and by tidal fields of their host halos. We also show that chemical pollution of GC-forming GMCs by stellar winds from massive stars can result in star-to-star abundance inhomogeneities among light elements (e.g., C, N, and O) of stars in GCs. The present model with a canonical initial mass function (IMF) also shows a C-N anticorrelation that stars with smaller [C/Fe] have larger [N/Fe] in a GC. Although these results imply that "self-pollution" of GC-forming GMCs by stellar winds from massive stars can cause abundance inhomogeneities of GCs, the present models with different parameters and canonical IMFs can not show N-rich stars with [N/Fe] $\sim 0.8$ observed in some GCs (e.g., NGC 6752). We discuss this apparent failure in the context of massive star formation preceding low-mass one within GC-forming GMCs ("bimodal star formation scenario"). We also show that although almost all stars ($\sim$97%) show normal He abundances (Y) of $\sim$0.24 some stars later formed in GMCs can have Y as high as $\sim$0.3 in some models. The number fraction of He-rich stars with $Y > 0.26$ is however found to be small ($\sim 10^{-3}$) for most models.

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# A new method to derive star formation histories of galaxies from their star cluster distributions

**Maschberger, Thomas; Kroupa, Pavel**
Argelander-Institut fuer Astronomie, Bonn; Rhine Stellar Dynamics Network

Star formation happens in a clustered way which is why the star cluster population of a particular galaxy is closely related to the star formation history of this galaxy. From the probabilistic nature of a mass function follows that the mass of the most-massive cluster of a complete population, $M_{\rm max}$, has a distribution with the total mass of the population as a parameter. The total mass of the population is connected to the star formation rate (SFR) by the length of a formation epoch.

Since due to evolutionary effects only massive star clusters are observable up to high ages it is convenient to use this $M_{\rm max}$(SFR) relation for the reconstruction of a star formation history. The age-distribution of the most-massive clusters can therefore be used to constrain the star formation history of a galaxy. The method, including an assessment of the inherent uncertainties, is introduced with this contribution, while following papers will apply this method to a number of galaxies.

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# 7. Miscellaneous

## The Effect of Binarity on Stellar Rotation - Beyond the Reach of Tides

**S. Meibom, R. D. Mathieu, K. G. Stassun**
Harvard-Smithsonian Center for Astrophysics Astronomy Department, University of Wisconsin - Madison Physics and Astronomy Department, Vanderbilt University

We present a comparison between the rotation period distributions of solar-type single stars and primary stars in close binaries (0.1 AU $<$ a $<$ 5 AU) in the young (150 Myr) open cluster M35 (NGC 2168). We find that the primary stars in the close binaries rotate faster than the single stars, on average. The differences in the means and medians between the period distributions are statistically significant at the 99.9% level or higher. The faster rotation among the primary stars in close binaries is not due to tidal synchronization as tidally evolved stars are excluded from the comparison. We discuss this result in the context of different early-evolution accretion processes and star-disk interactions for single stars and stars in close binaries.

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# Mode stability in delta Scuti stars: linear analysis versus observations in open clusters

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A comparison between linear stability analysis and observations of pulsation modes in five delta Scuti stars, belonging to the same cluster, is presented. The study is based on the work by Michel et al. (1999), in which such a comparison was performed for a representative set of model solutions obtained independently for each individual star considered. In this paper we revisit the work by Michel et al. (1999) following, however, a new approach which consists in the search for a single, complete, and coherent solution for all the selected stars, in order to constrain and test the assumed physics describing these objects. To do so, refined descriptions for the effects of rotation on the determination of the global stellar parameters and on the adiabatic oscillation frequency computations are used. In addition, a crude attempt is made to study the role of rotation on the prediction of mode instabilities.The present results are found to be comparable with those reported by Mich! el et al. (1999) Within the temperature range $\log T_{eff} = 3.87 - 3.88$ agreement between observations and model computations of unstable modes is restricted to values for the mixing-length parameter alpha$_{nl} \sim 1.50$. This indicates that for these stars a smaller value for alpha$_{nl}$ is required than suggested from a calibrated solar model. We stress the point that the linear stability analysis used in this work still assumes stellar models without rotation and that further developments are required for a proper description of the interaction between rotation and pulsation dynamics.

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# First Announcement

# MODEST-8

## 5-8, December, 2007
## Bonn/Bad Honnef, Germany

The stellar-dynamics group at the Argelander Institute for Astronomy (AIfA) wishes to invite the dense-stellar-systems community to the 8th annual meeting of the MODEST consortium, MODEST-8, and the fourth annual meeting of the Rhine Stellar dynamics Network, RSDN.

**Scientific Rationale:**

The fundamental building blocks of galaxies are dense stellar systems: star clusters. These range from open clusters at the low-mass end to massive star-burst systems containing millions of stars, some of which may evolve to globular clusters. The fraction of massive star-burst clusters that do so remains unknown and heavily debated. The physics of star-cluster formation has many unknowns, but it is becoming increasingly clear that the processes driving cluster assembly also have a significant impact on the morphology and kinematical properties of whole galaxies. Clusters re-shape their stellar population through dynamical encounters that dissociate multiple stars but which can also merge stars. Star clusters are environments in which gravitational dynamics meets stellar physics such that the evolution towards energy equipartition is significantly affected by stellar evolution since both time-scales are comparable. Dealing with these processes therefore poses extreme computational challenges, leading to the development of innovative software and hardware super-computer solutions. Because stars are of the same age and metal composition in most star clusters, these systems also offer excellent environments for testing stellar evolution theory. Observations of such systems stand therefore at the fore-front of observational astrophysics, ranging from star-by-star scrutiny to observations of extra-galactic star-cluster systems in old but also in massively interacting galaxies.

**Venue:**

The MODEST-8 meeting will be taking place in the Physics Centre of Bad Honnef nearby to Bonn, http://www.pbh.de/en/index.shtml This is a beautiful ambiente on the River Rhine. Conference participants stay in the Physics Centre which also has its own beer cellar. The nearby Christmas market in Bonn will provide some additional relaxation with one or more Gluehweins and other seasonal specialities.

**Programme:**

The programme for MODEST-8 has not been finalised yet, but the idea is to have an exchange between observers and theoreticians working on globular clusters and other dense stellar systems, and their distributions. We plan to incorporate plenty of time for discussions, including beer, also in small sub-groups.

**Register:**

Please register at the following URL: http://www.astro.uni-bonn.de/∼modest8/. There will be no conference fee. It is planned that all participants stay at the physics centre in Bad Honnef, although

hotels are also available in Bad Honnef. There are about 80 beds available at the physics centre, some of which are in double rooms. The cost of staying at the physics centre is about 55 euro per night, which includes three meals per day and the coffee breaks.

Pavel Kroupa and Holger Baumgardt on behalf of the SOC (Michael Hilker, Piet Hut, Pavel Kroupa, Steve McMillan) and the LOC (Holger Baumgardt, Claudia Bruens, Pavel Kroupa, Joerg Dabringhausen, Thomas Maschberger, Manuel Metz).