$\mathcal{SCYON}$

The Star Clusters Young & Old Newsletter

edited by Holger Baumgardt, Ernst Paunzen and Pavel Kroupa

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`http://astro.u-strasbg.fr/scyon`

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EDITORIAL

This is the 47th issue of the SCYON newsletter. In total we have 15 abstracts from refereed publications. We also have the second announcement for the MODEST-10 conference in Beijing in September this year. We finally have an announcement for a new version of the Open Star Cluster Catalogue by Dias et al.

AS usual we would like to thank all who sent us 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

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

A MAD view of Trumpler 14

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We present adaptive optics (AO) near-infrared observations of the core of the Tr 14 cluster in the Carina region obtained with the ESO multi-conjugate AO demonstrator, MAD. Our campaign yields AO-corrected observations with an image quality of about 0.2" across the 2' field of view, which is the widest AO mosaic ever obtained. We detected almost 2000 sources spanning a dynamic range of 10 mag. The pre-main sequence (PMS) locus in the colour-magnitude diagram is well reproduced by Palla & Stahler isochrones with an age of 3 to $5\text{x}10^5$ yr, confirming the very young age of the cluster. We derive a very high (deprojected) central density $n_0 \sim 4.5(\pm0.5)\text{x}10^4$ pc^{-3} and estimate the total mass of the cluster to be about $\sim 4.3^{+3.3}_{-1.5}\text{x}10^3$ M$_\odot$, although contamination of the field of view might have a significant impact on the derived mass. We show that the pairing process is largely dominated by chance alignment so that physical pairs are difficult to disentangle from spurious ones based on our single epoch observation. Yet, we identify 150 likely bound pairs, 30% of these with a separation smaller than 0.5" ($\sim$1300 AU). We further show that at the 2σ level massive stars have more companions than lower-mass stars and that those companions are respectively brighter on average, thus more massive. Finally, we find some hints of mass segregation for stars heavier than about 10M$_\odot$. If confirmed, the observed degree of mass segregation could be explained by dynamical evolution, despite the young age of the cluster.

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Tidally induced brown dwarf and planet formation in circumstellar discs

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Most stars are born in clusters and the resulting gravitational interactions between cluster members may significantly affect the evolution of circumstellar discs and therefore the formation of planets and brown dwarfs. Recent findings suggest that tidal perturbations of typical circumstellar discs due to close encounters may inhibit rather than trigger disc fragmentation and so would seem to rule out planet formation by external tidal stimuli. However, the disc models in these calculations were restricted to disc radii of 40 AU and disc masses below 0.1 $M_\odot$. Here we show that even modest encounters can trigger fragmentation around 100 AU in the sorts of massive ($\sim$0.5 $M_\odot$), extended ($\geq$100 AU) discs that are observed around young stars. Tidal perturbation alone can do this, no disc-disc collision is required. We also show that very-low-mass binary systems can form through the interaction of objects in the disc. In our computations, otherwise non-fragmenting massive discs, once perturbed, fragment into several objects between about 0.01 and 0.1 $M_\odot$, i.e. over the whole brown dwarf mass range. Typically these orbit on highly eccentric orbits or are even ejected. While probably not suitable for the formation of Jupiter- or Neptune-type planets, our scenario provides a possible formation mechanism for brown dwarfs and very massive planets which, interestingly, leads to a mass distribution consistent with the canonical substellar IMF. As a minor outcome, a possible explanation for the origin of misaligned extrasolar planetary systems is discussed.

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2. Galactic Open Clusters

Internal dynamics and membership of the NGC 3603 Young Cluster from microarcsecond astrometry

Iain McDonald ([1]), Gregory C. Sloan ([2]), Albert A. Zijlstra ([1]), Noriyuki Matsunaga ([3]), Mikako Matsuura ([4,5]), Kathleen E. Kraemer ([6]), Jeronimo Bernard-Salas ([2]), and Andrew J. Markwick ([1])

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Iron, the Universe's most abundant refractory element, is highly depleted in both circumstellar and interstellar environments, meaning it exists in solid form. The nature of this solid is unknown. In this Letter, we provide evidence that metallic iron grains are present around oxygen-rich AGB stars, where it is observationally manifest as a featureless mid-infrared excess. This identification is made using Spitzer Space Telescope observations of evolved globular cluster stars, where iron dust production appears ubiquitous and in some cases can be modelled as the only observed dust product. In this context, FeO is examined as the likely carrier for the 20-micron feature observed in some of these stars. Metallic iron appears to be an important part of the dust condensation sequence at low metallicity, and subsequently plays an influential role in the interstellar medium. We explore the stellar metallicities and luminosities at which iron formation is observed, and how the presence of iron affects the outflow and its chemistry. The conditions under which iron can provide sufficient opacity to drive a wind remain unclear.

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Fitting Isochrones to Open Cluster photometric data: A new global optimization tool

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We present a new technique to fit color-magnitude diagrams of open clusters based on the Cross-Entropy global optimization algorithm. The method uses theoretical isochrones available in the literature and maximizes a weighted likelihood function based on distances measured in the color-magnitude space. The weights are obtained through a non parametric technique that takes into account the star distance to the observed center of the cluster, observed magnitude uncertainties, the stellar density profile of the cluster among others. The parameters determined simultaneously are distance, reddening, age and metallicity. The method takes binary fraction into account and uses a Monte-Carlo approach to obtain uncertainties on the determined parameters for the cluster by running the fitting algorithm many times with a re-sampled data set through a bootstrapping procedure. We present results for 9 well studied open clusters, based on 15 distinct data sets, and show that the results are consistent with previous studies. The method is shown to be reliable and free of the subjectivity of most previous visual isochrone fitting techniques.

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The population of OB supergiants in the starburst cluster Westerlund 1

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After leaving the main sequence, massive stars undergo complex evolution, which is still poorly understood. With a population of hundreds of OB stars, the starburst cluster Westerlund 1 offers an unparallelled environment to study their evolutionary tracks. We characterise a large sample of evolved OB stars in the cluster, with the aim of determining cluster parameters and place stars in an evolutionary sequence. We used the FORS2 instrument on the VLT to obtain intermediate-resolution spectroscopy over the range 5800-9000A of about a hundred stars selected as likely members of the cluster based on their photometry. We developed criteria for their spectral classification using only spectral features in the range observed. We discuss these criteria, useful for spectral classification of early-type stars in the GAIA spectral region, in the appendix. Using these criteria, we obtain spectral classifications, probably accurate to one subtype, for 57 objects, most of which had no previous classification or a generic classification. We identify more than 50 objects as OB supergiants. We find almost 30 luminous early-B supergiants and a number of less luminous late-O supergiants. In addition, we find a few mid B supergiants with very high luminosity, some of them displaying signs of heavy mass loss. All these stars form a sequence compatible with theoretical evolutionary tracks. In addition, two early B supergiants also show indication of heavy mass loss and may represent the evolutionary phase immediately prior to the Wolf-Rayet stage. We investigate cluster properties using the spectral types and existing photometry. We find that the reddening law to the cluster does not deviate strongly from standard, even though extinction is quite variable, with an average value AV = 10.8. Though evolutionary tracks for high-mass stars are subject to large uncertainties, our data support an age of $\geq$ 5 Myr and a distance d $\sim$ 5kpc for Westerlund 1. The spectral types observed are compatible with a single burst of star formation (the age range is very unlikely to be $>$ 1 Myr). Westerlund 1 shows its potentiality as a laboratory for massive star evolution, which can be fulfilled by detailed study of the population presented here.

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On the metallicity of open clusters I. Photometry

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Metallicity is one of four free parameters typically considered when fitting isochrones to the cluster sequence. Unfortunately, this parameter is often ignored or assumed to be solar in most papers. Hence an unknown bias is introduced in the estimation of the other three cluster parameters (age, reddening and distance). Furthermore, studying the metallicity of open clusters allows us not only to derive the Galactic abundance gradient on a global scale, but also to trace the local solar environment in more detail. In a series of three papers, we investigate the current status of published metallicities for open clusters from widely different photometric and spectroscopic methods. A detailed comparison of the results allows us to establish more reliable photometric calibrations and corrections for isochrone fitting techniques. Well established databases such as WEBDA help us to perform a homogeneous analysis of available measurements for a significant number of open clusters. The literature was searched for [Fe/H] estimates on the basis of photometric calibrations in any available filter system. On the basis of results published by Tadross, we demonstrate the caveats of the calibration choice and its possible impact. In total, we find 406 individual metallicity values for 188 open clusters within 64 publications. The values were, finally, unweightedly averaged. Our final sample includes [Fe/H] values for 188 open clusters. Tracing the solar environment within $4000 \times 4000\,\mathrm{pc}^2$ we identify a patchy metallicity distribution as an extension to the Local Bubble that significantly influences the estimation of the Galactic metallicity gradient, even on a global scale. In addition, further investigations of more distant open clusters are clearly needed to obtain a more profound picture at Galactocentric distances beyond 10 000 pc. Only a combination of all available photometric and spectroscopic data will shed more light on how the local and global Galactic properties are correlated with metallicity.

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Internal dynamics and membership of the NGC 3603 Young Cluster from microarcsecond astrometry

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We have analyzed two epochs of HST/WFPC2 observations of the young Galactic starburst cluster in NGC 3603 with the aim to study its internal dynamics and stellar population. Relative proper motions measured over 10.15 yrs of more than 800 stars enable us to distinguish cluster members from field stars. The best-fitting isochrone yields Av=4.6-4.7 mag, a distance of 6.6-6.9 kpc, and an age of 1 Myr for NGC 3603 Young Cluster (NYC). We identify pre-main-sequence/main-sequence transition stars located in the short-lived radiative-convective gap, which in the NYC occurs in the mass range 3.5-3.8 Msun. We also identify a sparse population of stars with an age of 4 Myr, which appear to be the lower mass counterparts to previously discovered blue supergiants located in the giant HII region NGC 3603. For the first time, we are able to measure the internal velocity dispersion of a starburst cluster from 234 stars with I < 18.5 mag to σ_{pm1D}=141 $\pm$ 27 μas/yr^{-1} (4.5 $\pm$ 0.8 km/s at a distance of 6.75 kpc). As stars with masses between 1.7 and 9 Msun all exhibit the same velocity dispersion, the cluster stars have not yet reached equipartition of kinetic energy (i.e., the cluster is not in virial equilibrium). The results highlight the power of combining high-precision astrometry and photometry, and emphasize the role of NYC as a benchmark object for testing stellar evolution models and dynamical models for young clusters and as a template for extragalactic starburst clusters.

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3. Galactic Globular Clusters

Initial conditions for globular clusters and assembly of the old globular cluster population of the Milky Way

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By comparing the outcome of N-body calculations that include primordial residual-gas expulsion with the observed properties of 20 Galactic globular clusters (GCs) for which the stellar mass function (MF) has been measured, we constrain the time-scale over which the gas of their embedded cluster counterparts must have been removed, the star formation efficiency the progenitor cloud must have had and the strength of the tidal-field the clusters must have formed in. The three parameters determine the expansion and mass-loss during residual-gas expulsion. After applying corrections for stellar and dynamical evolution we find birth cluster masses, sizes and densities for the GC sample and the same quantities for the progenitor gas clouds. The pre-cluster cloud core masses were between 10^5 - 10^7 $M_\odot$ and half-mass radii were typically below 1 pc and reach down to 0.2 pc. We show that the low-mass present day MF (PDMF) slope, initial half-mass radius and initial density of clusters correlates with cluster metallicity, unmasking metallicity as an important parameter driving cluster formation and the gas expulsion process. This work predicts that PD low-concentration clusters should have a higher binary fraction than PD high-concentration clusters. Since the oldest GCs are early residuals from the formation of the Milky Way (MW) and the derived initial conditions probe the environment in which the clusters formed, we use the results as a new tool to study the formation of the inner GC system of the Galaxy. We achieve time-resolved insight into the evolution of the pre-MW gas cloud on short time-scales (a few hundred Myr) via cluster metallicities. The results are shown to be consistent with a contracting and self-gravitating cloud in which fluctuations in the pre-MW potential grow with time. An initially relatively smooth tidal-field evolved into a grainy potential within a dynamical time-scale of the collapsing cloud.

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Discovery of long-period variable stars in the very-metal-poor globular cluster M15

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We present a search for long-period variable (LPV) stars among giant branch stars in M15 which, at [Fe/H] $\sim$ -2.3, is one of the most metal-poor Galactic globular clusters. We use multi-colour optical photometry from the 0.6-m Keele Thornton and 2-m Liverpool Telescopes. Variability of delta-V $\sim$ 0.15 mag is detected in K757 and K825 over unusually-long timescales of nearly a year, making them the most metal-poor LPVs found in a Galactic globular cluster. K825 is placed on the long secondary period sequence, identified for metal-rich LPVs, though no primary period is detectable. We discuss this variability in the context of dust production and stellar evolution at low metallicity, using additional spectra from the 6.5-m Magellan (Las Campanas) telescope. A lack of dust production, despite the presence of gaseous mass loss raises questions about the production of dust and the intra-cluster medium of this cluster.

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A mass estimate of an intermediate-mass black hole in omega Centauri

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Context. The problem of the existence of intermediate-mass black holes (IMBHs) at the centre of globular clusters is a hot and controversial topic in current astrophysical research with important implications in stellar and galaxy formation.

Aims. In this paper, we aim at giving further support to the presence of an IMBH in omega Centauri and at providing an independent estimate of its mass.

Methods. We employed a self-consistent spherical model with anisotropic velocity distribution. It consists in a generalisation of the King model by including the Bahcall-Wolf distribution function in the IMBH vicinity.

Results. By the parametric fitting of the model to recent HST/ACS data for the surface brightness profile, we found an IMBH to cluster total mass ratio of MBH/M = $5.8^{+0.9}_{-1.2}$ x 10^{-3}. It is also found that the model yields a fit of the line-of-sight velocity dispersion profile that is better without mass segregation than in the segregated case. This confirms the current thought of a non-relaxed status for this peculiar cluster. The best fit model to the kinematic data leads, moreover, to a cluster total mass estimate of M = (3.1 ± 0.3) x 10^6 $M_\odot$, thus giving an IMBH mass in the range 13,000 < MBH < 23,000 $M_\odot$ (at 1-sigma confidence level). A slight degree of radial velocity anisotropy in the outer region (r > 12') is required to match the outer surface brightness profile.

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4. Galactic Center Clusters

Concerning the Distance to the Center of the Milky Way and its Structure

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The distance to the Galactic center inferred from OGLE RR Lyrae variables observed in the direction of the bulge is Ro=8.1+-0.6 kpc. An accurate determination of Ro is hindered by countless effects that include an ambiguous extinction law, a bias for smaller values of Ro because of a preferential sampling of variable stars toward the near side of the bulge owing to extinction, and an uncertainty in characterizing how a mean distance to the group of variable stars relates to Ro. A VI-based period-reddening relation for RR Lyrae variables is derived to map extinction throughout the bulge. The reddening inferred from RR Lyrae variables in the Galactic bulge, LMC, SMC, and IC 1613 match that established from OGLE red clump giants and classical Cepheids. RR Lyrae variables obey a period-colour (VI) relation that is relatively insensitive to metallicity. Edge-on and face-on illustrations of the Milky Way are constructed by mapping the bulge RR Lyrae variables in tandem with cataloged red clump giants, globular clusters, planetary nebulae, classical Cepheids, young open clusters, HII regions, and molecular clouds. The sample of RR Lyrae variables do not trace a prominent Galactic bar or triaxial bulge oriented at phi$\sim$25 degrees.

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5. Extragalactic Clusters

Evidence for an accretion origin for the outer halo globular cluster system of M31

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We use a sample of newly-discovered globular clusters from the *Pan-Andromeda Archaeological Survey* (PAndAS) in combination with previously-catalogued objects to map the spatial distribution of globular clusters in the M31 halo. At projected radii beyond ≈ 30 kpc, where large coherent stellar streams are readily distinguished in the field, there is a striking correlation between these features and the positions of the globular clusters. Adopting a simple Monte Carlo approach, we test the significance of this association by computing the probability that it could be due to the chance alignment of globular clusters smoothly distributed in the M31 halo. We find the likelihood of this possibility is low, below 1%, and conclude that the observed spatial coincidence between globular clusters and multiple tidal debris streams in the outer halo of M31 reflects a genuine physical association. Our results imply that the majority of the remote globular cluster system of M31 has been assembled as a consequence of the accretion of cluster-bearing satellite galaxies. This constitutes the most direct evidence to date that the outer halo globular cluster populations in some galaxies are largely accreted.

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The first gigayear of bulge star formation in Virgo ellipticals: constraints from their globular cluster systems

Lee R. Spitler
Swinburne University

Data products from the Advanced Camera for Surveys Virgo cluster survey are used to understand the bulge star formation history in early-type galaxies at redshifts z > 2. A new technique is developed whereby observed high-redshift age-metallicity relationships are utilized to constrain the typical formation epochs of metal-rich or 'bulge' globular clusters. This analysis supports a model where massive Virgo galaxies underwent an extremely intense mode of bulge globular cluster formation at z ∼ 3.5 that was followed by an era of significant bulge growth and little globular cluster production. Intermediate-mass galaxies showed a less intense period of globular cluster formation at z ∼ 2.5 that was synchronized with the bulk of bulge star growth. The transition between the massive and intermediate-mass galaxy star formation modes occurs at a galaxy stellar mass of $M_{stellar} \sim 3\ 10^{10}\ M_{solar}$, the mass where many other galaxy properties are observed to change. Dwarf early-type galaxies in Virgo may have experienced no significant period of bulge globular cluster formation, thus the intense starbursts associated with globular cluster formation may be difficult to directly observe at redshifts z < 4. Although the above conclusions are preliminary because they are based upon uncertain relationships between age and metallicity, the technique employed will yield more stringent constraints as high-redshift galaxy observations and theoretical models improve.

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6. Dynamical evolution - Simulations

Evolution of two stellar populations in globular clusters II. Effects of primordial gas expulsion

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We investigate the early evolution of two distinct populations of low-mass stars in globular clusters under the influence of primordial gas expulsion driven by supernovae to study if this process can increase the fraction of second generation stars at the level required by observations. We analyse N-body models that take into account the effect of primordial gas expulsion. We divide the stars into two populations which mimic the chemical and dynamical properties of stars in globular clusters so that second generation stars start with a more centrally concentrated distribution. The main effect of gas expulsion is to eject preferentially first generation stars while second generation stars remain bound to the cluster. In the most favourable cases second generation stars can account for 60% of the bound stars we see today. We also find that at the end of the gas expulsion phase, the radial distribution of the two populations is still different, so that long-term evolution will further increase the fraction of second generation stars. The large fraction of chemically anomalous stars is readily explainable as a second generation of stars formed out of the slow winds of rapidly rotating massive stars if globular clusters suffer explosive residual gas expulsion for a star formation efficiency of about 0.33.

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Peculiarities in Velocity Dispersion and Surface Density Profiles of Star Clusters

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Based on our recent work on tidal tails of star clusters (Küpper et al. 2009) we investigate star clusters of a few 10^4 $M_\odot$ by means of velocity dispersion profiles and surface density profiles. We use a comprehensive set of N-body computations of star clusters on various orbits within a realistic tidal field to study the evolution of these profiles with time, and ongoing cluster dissolution From the velocity dispersion profiles we find that the population of potential escapers, i.e. energetically unbound stars inside the Jacobi radius, dominates clusters at radii above about 50% of the Jacobi radius. Beyond 70% of the Jacobi radius nearly all stars are energetically unbound. The velocity dispersion therefore significantly deviates from the predictions of simple equilibrium models in this regime. We furthermore argue that for this reason this part of a cluster cannot be used to detect a dark matter halo or deviations from Newtonian gravity. By fitting templates to the about 10^4 computed surface density profiles we estimate the accuracy which can be achieved in reconstructing the Jacobi radius of a cluster in this way. We find that the template of King (1962) works well for extended clusters on nearly circular orbits, but shows significant flaws in the case of eccentric cluster orbits. This we fix by extending this template with 3 more free parameters. Our template can reconstruct the tidal radius over all fitted ranges with an accuracy of about 10%, and is especially useful in the case of cluster data with a wide radial coverage and for clusters showing significant extra-tidal stellar populations. No other template that we have tried can yield comparable results over this range of cluster conditions. All templates fail to reconstruct tidal parameters of concentrated clusters, however.

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MODEST-10

Encounters and interactions in dense stellar systems modeling, computing, and observations

The first main MODEST meeting in Asia; the first in China

30 August - 3 September 2010, Beijing, China

Dense stellar clusters are the birth places of stars and planetary systems, and form the building blocks of galaxies. The complex interplay between stellar dynamics, stellar evolution, and hydrodynamics is a challenge for astrophysical modelling and computer simulations. In recent years, significant progress has been made in the fields of N-body dynamics, hydrodynamics, radiative transport, and stellar evolution, and powerful hardware (GPUs and GRAPEs) has become available to vastly speed up simulations. In addition, a wealth of observational data have become available, and will emerge in the near future (LAMOST, GAIA). The combination of these advances has increased our understanding related to a range of fundamental topics in astronomy: star cluster formation and evolution, star formation, planetary dynamics, stellar structure and evolution, dynamics of the Galactic centre, the formation and evolution of galaxies, and cosmology. At the same time, fresh problems have emerged which challenge the basic paradigm of almost all recent work. Once regarded as an example of simple stellar populations, born simultaneously, rich clusters are known to have a more complicated history, which affects everything, from their dynamical evolution to their composition.

Understanding the formation and evolution of star clusters is a challenging task which requires the collaboration and the exchange of ideas of astronomers, physicists, and computer scientists with observational and theoretical expertise in Galactic and extragalactic astronomy, stellar dynamics, hydrodynamics, stellar evolution, and software/hardware development.

The MODEST (Modeling Dense Stellar Clusters; http://manybody.org/modest) collaboration is a loosely knit international collaboration between various groups working in stellar dynamics, stellar evolution, stellar hydrodynamics, and related research areas. One of the main activities of the collaboration is to provide a software framework for large-scale simulations of dense stellar systems, in which existing codes for dynamics, stellar evolution, and hydrodynamics can be easily coupled, and place them in the appropriate observational context.

In recent years, China has experienced a significant development in both fundamental and computational science. Given the bright future for these fields, it is appropriate for the MODEST-10 meeting to be held in China. During the workshop, we will look back at the progress made during the first ten yours of MODEST, and set our goals for the upcoming decade. This MODEST-10 workshop focuses primarily on, but is not limited to:

1. The formation and evolution of star clusters, from birth to death, including the issues of infant mortality, stellar multiplicity, the initial mass function, mass segregation, and the effect of tidal fields
2. Resolved globular clusters and globular cluster systems in nearby and distant galaxies
3. Dwarf galaxies, the formation of tidal dwarfs and nuclear star clusters
4. Exotic objects in dense stellar systems (blue stragglers, contact binaries, black holes, and other compact objects)
5. The dynamics of planetary systems in star cluster environments
6. Modeling of galactic nuclei, including our own Galactic centre; the interaction between stars, star clusters and supermassive black holes

7. Comparison between observations and simulations; preparing for large surveys in the upcoming decade
8. High-performance computational facilities (GPUs, GRAPEs, supercomputers) and innovative computing environments (grids, MUSE)

The MODEST-10 workshop will be held from **30 August to 3 September 2010** in Beijing, China. It is jointly organized by the National Astronomical Observatories (NAOC), Chinese Academy of Sciences, and the Kavli Institute for Astronomy and Astrophysics (KIAA) at Peking University. Registration is possible at **http://silk0.bao.ac.cn/modest10/**, and further information can be obtained by contacting modest10@kiaa.pku.edu.cn.

New catalogue of optically visible open clusters and candidates - version 3.0 (2010)

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We are pleased to announce that the most recent version (3.0) of the DAML02 Catalogue is available online. In this new edition (version 3.0), we included 311 new open cluster candidates in the database. Virtually all papers published after the version 2.9 of the catalogue were investigated resulting in the inclusion of new fundamental parameters, mean radial velocities and metallicities for various clusters. Corrections of coordinates, apparent diameters and names for the open clusters were performed. 306 open clusters discovered in the infra-red but appearing in DSS images were inserted.

The complete statistical information is:

Number of clusters: 2095
Clusters with Diameters: 2080 (99.3%)
Clusters with Distances: 1192 (56.9%)
Clusters with Reddening: 1191 (56.8%)
Clusters with Ages: 1147 (54.7%)
Clusters with Dist,Redd. and Ages: 1137 (54.3%)
Clusters with Proper motions: 890 (42.5%)
Clusters with Radial velocities: 504 (24.5%)
Clusters with P.Motions + RVs: 483 (23.1%)
Clusters with Dist,Ages,PMS and RVs: 472 (22.5%)
Clusters with Abundances: 179 (8.5%)

This catalogue is being constantly updated and maintained in electronic form for the widest possible accessibility. The latest version (3.0) can be accessed on line at http://www.astro.iag.usp.br/~wilton All efforts are being made to examine critically the data included in the catalogue, specially when data from different authors are available. Part of the data are results of our own measurements, and a number of private communications are included. The data sources are always stated. This catalogue has been used and cited in more than 200 papers. Like in the past more than one catalogue were available in the literature, the present one is does not intend to be the unique one, but it is certainly a major one. Please, send your comments, suggestions and published results.

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Also available from the URL `http://www.astro.iag.usp.br/~wilton`

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