$\mathcal{SCYON}$

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

Here is the 38th issue of the SCYON newsletter. Todays edition contains 24 abstracts from referred journals and an announcement for a new version of the DAML02 Open Cluster database. It also contains announcements for conferences in Turku and Vienna and a job advertisement for a PhD position at the Observatoire astronomique de Strasbourg.

As usual we would like to thank all 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.

Concerning possible infringements to copyright laws, we understand that the authors themselves are taking responsibility for the material they send us. We make no claim whatsoever to owning the material that is posted at our url or circulated by email. The newsletter SCYON is a free service. It does not substitute for our personal opinions, nor does it reflect in any way the views of our respective institutes of affiliations.

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

Core Mass Function: The Role of Gravity

Sami Dib ([1,2,4]), Axel Brandenburg ([3]), Jongsoo Kim ([4]), Maheswar Gopinathan ([4,5]), Philippe Andre ([1])

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We analyze the mass distribution of cores formed in an isothermal, magnetized, turbulent, and self-gravitating nearly critical molecular cloud model. Cores are identified at two density threshold levels. Our main results are that the presence of self-gravity modifies the slopes of the core mass function (CMF) at the high mass end. At low thresholds, the slope is shallower than the one predicted by pure turbulent fragmentation. The shallowness of the slope is due to the effects of core coalescence and gas accretion. Most importantly, the slope of the CMF at the high mass end steepens when cores are selected at higher density thresholds, or alternatively, if the CMF is fitted with a log-normal function, the width of the lognormal distribution decreases with increasing threshold. This is due to the fact that gravity plays a more important role in denser structures selected at higher density threshold and leads to the conclusion that the role of gravity is essential in generating a CMF that bears more resemblance with the IMF when cores are selected with an increasing density threshold in the observations.

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Also available from the URL `http://fr.arxiv.org/abs/0801.2257`
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Wide-Field Infrared Imaging Polarimetry of the NGC 6334 Region: A Nest of Infrared Reflection Nebulae

J. Hashimoto[1], M. Tamura[1], R. Kandori[1], N. Kusakabe[1], Y. Nakajima[1], M. Kurita[2], T. Nagata[3], T. Nagayama[3], J. Hough[4], A. Chrysostomou[5]

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We report the detection of eighteen infrared reflection nebulae (IRNe) in the J, H, & Ks linear polarimetric observations of the NGC 6334 massive star-formation complex, of which 16 IRNe are new discoveries. Our images cover ∼180 square arcminutes, one of the widest near-infrared polarization data in star-formation regions so far. These IRNe are most likely associated with embedded young OB stars at different evolutionary phases, showing a variety of sizes, morphologies, and polarization properties, which can be divided into four categories. We argue the different nebula characteristics to be a possible evolutionary sequence of circumstellar structures around young massive stars.

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2. Galactic Open Clusters

The effect of rotation on the abundances of the chemical elements of the A–type stars in the Praesepe cluster

L. Fossati[1] and S. Bagnulo[2] and J. Landstreet[3] and G. Wade[4] and O. Kochukhov[5] and R. Monier[6] and W. Weiss[1] and M. Gebran[7]

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We study how chemical abundances of late B–, A–, and early F–type stars evolve with time, and we search for correlations between the abundance of chemical elements and other stellar parameters, such as effective temperature and $v \sin i$. We observed a large number of B–, A–, and F–type stars belonging to open clusters of different ages. In this paper we concentrate on the Praesepe cluster ($\log t = 8.85$), for which we have obtained high–resolution, high signal–to–noise ratio spectra of sixteen normal A– and F–type stars and one Am star, using the SOPHIE spectrograph of the Observatoire de Haute–Provence. For all the observed stars, we derived fundamental parameters and chemical abundances. In addition, we discuss another eight Am stars belonging to the same cluster, for which the abundance analysis had been presented in a previous paper. We find a strong correlation between the peculiarity of Am stars and $v \sin i$. The abundance of the elements underabundant in Am stars increases with $v \sin i$, while it decreases for the overabundant elements. Chemical abundances of various elements appear correlated with the iron abundance.

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Open Clusters as Galactic Disk Tracers: I. Project Motivation, Cluster Membership and Bulk Three-Dimensional Kinematics

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We have begun a survey of the chemical and dynamical properties of the Milky Way disk as traced by open star clusters. In this first contribution, the general goals of our survey are outlined and the strengths and limitations of using star clusters as a Galactic disk tracer sample are discussed. We also present medium resolution ($R \sim 15,0000$) spectroscopy of open cluster stars obtained with the Hydra multi-object spectrographs on the Cerro Tololo Inter-American Observatory 4-m and WIYN 3.5-m telescopes. Here we use these data to determine the radial velocities of 3436 stars in the fields of open clusters within about 3 kpc, with specific attention to stars having proper motions in the Tycho-2 catalog. Additional radial velocity members (without Tycho-2 proper motions) that can be used for future studies of these clusters were also identified. The radial velocities, proper motions, and the angular distance of the stars from cluster center are used to derive cluster membership probabilities for stars in each cluster field using a non-parametric approach, and the cluster members so-identified are used, in turn, to derive the reliable bulk three-dimensional motion for 66 of 71 targeted open clusters. The high probability cluster members that we identify help to clarify the color-magnitude sequences for many of the clusters, and are prime targets for future echelle resolution spectroscopy as well as astrometric study with the Space Interferometry Mission (SIM Planetquest).

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Also available from the URL http://arxiv.org/abs/0804.4630

Chemical composition of A and F dwarfs members of the Pleiades open cluster

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We derive the abundances of 18 chemical elements for 16 A-dwarf, both normal and chemically-peculiar, and 5 F-dwarf members of the Pleiades open cluster to place constraints on evolutionary models. Abundances and rotational and microturbulent velocities were derived by fitting synthetic spectra to high-resolution (R∼42000 and R∼75000) observations of high signal-to-noise ratio (S/N). The abundances exhibit correlation with neither the effective temperature nor the projected rotational velocity. Interestingly, A stars exhibit larger star-to-star variations in C, Sc, Ti, V, Cr, Mn, Sr, Y, Zr and Ba, than F stars. F stars have solar abundances of almost all elements. In A stars, the abundances of Si, Ti and Cr are correlated with that of Fe, and the [X/Fe] ratios are solar for these three elements. The derived abundances are compared with the predictions of evolutionary models for the age of Pleiades (100 Myr). For F stars, small predicted underabundances of light elements and overabundances of Cr, Fe and Ni are confirmed by our findings. For A stars, the predicted overabundances in iron-peak elements are confirmed for a few stars only. The large scatter in the abundances of A stars, discovered previously in the Hyades, Coma Berenices, UMa group, and in field stars, appears to be a characteristic property of dwarf A stars. Hydrodynamical processes competing with radiative diffusion in the radiative zone of A dwarfs, could account for the scatter in abundances that we determine.

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Chemical composition of A and F dwarf members of the Coma Berenices open cluster

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Abundances of 18 chemical elements have been derived for 11 A (normal and Am) and 11 F dwarfs members of the Coma Berenices open cluster in order to set constraints on evolutionary models including transport processes (radiative and turbulent diffusion) calculated with the Montréal code. A spectral synthesis iterative procedure has been applied to derive the abundances from selected high quality lines in high resolution high signal-to-noise échelle spectra obtained with ELODIE at the Observatoire de Haute Provence. The chemical pattern found for the A and F dwarfs in Coma Berenices is reminiscent of that found in the Hyades and the UMa moving group. In graphs representing the abundances [X/H] versus the effective temperature, the A stars often display abundances much more scattered around their mean values than the F stars do. Large star-to-star variations are detected for A stars in their abundances of C, O, Na, Sc, Ti, Mn, Fe, Ni, Sr, Y, Zr and Ba which we interpret as evidence of transport processes competing with radiative diffusion. The abundances of Mn, Ni, Sr and Ba are strongly correlated with that of iron for A and Am stars. In contrast the ratios [C/Fe] and [O/Fe] appear to be anticorrelated with [Fe/H] as found earlier for field A dwarfs. All Am stars in Coma Berenices are deficient in C and O and overabundant in elements heavier than Fe but not all are deficient in calcium and/or scandium. The F stars have solar abundances for almost all elements except for Mg, Si, V and Ba. The derived abundances patterns, [X/H] versus atomic number, for the slow rotator HD108642 (A2m) and the moderately fast rotator HD106887 (A4m) were compared to the predictions of self consistent evolutionary model codes including radiative and different amounts of turbulent diffusion. None of the models reproduces entirely the overall shape of the abundance pattern. While part of the discrepancies between derived and predicted abundances may be accounted for by non-LTE effects, the inclusion of competing processes such as rotational mixing in the radiative zones of these stars seems necessary to improve the agreement between observed and predicted abundance patterns.

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Optical polarimetric study of open clusters: Distribution of Interstellar matter towards NGC 654

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We present new B, V and R linear polarimetric observations for 61 stars towards the region of the young open cluster NGC 654. In this study we found evidence for the presence of at least two layers of dust along the line of sight to the cluster. The distances to the two dust layers are estimated to be ~ 200 pc and ~ 1 kpc which are located much closer to the Sun than the cluster (~ 2.4 kpc). Both the dust layers have their local magnetic field orientation nearly parallel to the direction of the Galactic plane. The foreground dust layer is found to have a ring morphology with the central hole coinciding with the center of the cluster. The foreground dust grains are suggested to be mainly responsible for both the observed differential reddening and the polarization towards the cluster.

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Membership, binarity, and rotation of F-G-K stars in the open cluster Blanco 1

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The nearby open cluster Blanco 1 is of considerable astrophysical interest for formation and evolution studies of open clusters because it is the third highest Galactic latitude cluster known. It has been observed often, but so far no definitive and comprehensive membership determination is readily available.

An observing programme was carried out to study the stellar population of Blanco 1, and especially the membership and binary frequency of the F5-K0 dwarfs.

We obtained radial-velocities with the CORAVEL spectrograph in the field of Blanco 1 for a sample of 148 F-G-K candidate stars in the magnitude range $10 < V < 14$. New proper motions and $UBVI$ CCD photometric data from two extensive surveys were obtained independently and are used to establish reliable cluster membership assignments in concert with radial-velocity data.

The membership of 68 stars is confirmed on the basis of proper motion, radial velocity, and photometric criteria. Fourteen spectroscopic- and suspected binaries (2 SB2s, 9 SB1s, 3SB?) have been discovered among the confirmed members. Thirteen additional stars are located above the main sequence or close to the binary ridge, with radial velocities and proper motions supporting their membership. These are probable binaries with wide separations. Nine binaries (7 SB1 and 2 SB2) were detected among the field stars. The spectroscopic binary frequency among members is 20% (14/68); however, the overall binary rate reaches 40% (27/68) if one includes the photometric binaries. The cluster mean heliocentric radial velocity is $+5.53 \pm 0.11$ km s^{-1} based on the most reliable 49 members. The $V \sin i$ distribution is similar to that of the Pleiades, confirming the age similarities between the two clusters.

This study clearly demonstrates that, in spite of the cluster's high Galactic latitude, three membership criteria – radial velocity, proper motion, and photometry – are necessary for performing a reliable membership selection. Furthermore, even with accurate and extensive data, ambiguous cases still remain.

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Red giants in open clusters. XV. Mean radial velocities for 1309 stars and 166 open clusters

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We present the final catalogues of a long-term observing programme performed with the two CORAVEL spectrovelocimeters for red giants in open clusters. The main aims were to detect spectroscopic binaries and determine their orbital parameters, determine the membership, and compute mean velocities for the stars and open clusters.

We computed weighted mean radial velocities for 1309 stars from 10517 individual observations, including the systemic radial velocities from spectroscopic orbits and for cepheids.

The final results are contained in three catalogues collecting 10517 individual radial velocities, mean radial velocities for 1309 red giants, and mean radial velocities for 166 open clusters among which there are 57 new determinations. We identified 891 members and 418 non-members. We discovered a total of 288 spectroscopic binaries, among which 57 are classified as non-members. In addition 27 stars were judged to be variable in radial velocities and they are all red supergiants.

The present material, combined with recent absolute proper motions, will permit various investigation of the galactic distribution and space motions of a large sample of open clusters. However, the distance estimates still remain the weakest part of the necessary data. This paper is the last one in this series devoted to the study of red giants in open clusters based on radial velocities obtained with the CORAVEL instruments.

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RACE-OC Project: Rotation and variability in the open cluster NGC2099 (M37)

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Rotation and solar-type magnetic activity are closely related to each other in stars of G or later spectral types. Presence and level of magnetic activity depend on star's rotation and rotation itself is strongly influenced by strength and topology of the magnetic fields. Open clusters represent especially useful targets to investigate the connection between rotation and activity. The open cluster NGC2099 has been studied as a part of the RACE-OC project, which is aimed at exploring the evolution of rotation and magnetic activity in the late-type members of open clusters of different ages. Time series CCD photometric observations of this cluster were collected during January 2004. The relations between activity manifestations, such as the light curve amplitude, and global stellar parameters are investigated. We have discovered 135 periodic variables, 122 of which are candidate cluster members. Determination of rotation periods of G- and K-type stars has allowed us to better explore evolution of angular momentum at an age of about 500 Myr. A comparison with the older Hyades cluster (∼625 Myr) shows that the newly determined distribution of rotation periods is consistent with the scenario of rotational braking of main-sequence spotted stars as they age. However, a comparison with the younger M34 cluster (∼200 Myr) shows that the G8-K5 members of these clusters have the same rotation period distribution, that is G8-K5 members in NGC2099 seem to have experienced no significant braking in the age range from ∼200 to ∼500 Myr. Finally, NGC2099 members have a level of photospheric magnetic activity, as measured by light curve amplitude, smaller than in younger stars of same mass and rotation, suggesting that the activity level also depends on some other age-dependent parameters.

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Abstract

We aim at the construction of luminosity and mass functions of Galactic open clusters, based on integrated magnitudes and tidal masses. We also aim at studying the evolution of these functions, with the ultimate purpose of deriving the *initial* luminosity and mass distributions of star clusters, independent of model assumptions regarding the cluster mass-to-light ratio. Finally we aim at a new determination of the percentage of field stars that have originated in open clusters.

The integrated magnitudes are computed from individual photometry of cluster members selected from the ASCC catalogue. The cluster masses are assumed to be the estimated tidal mass recently published by us elsewhere. Analysis of the cluster brightness distribution as a function of apparent integrated magnitudes shows that the cluster sample drawn from the ASCC is complete down to apparent integrated magnitude $I_V = 8$, with 440 clusters and compact associations above this completeness limit. This, on average, corresponds to a completeness area in the Solar Neighbourhood with an effective radius of about 1 kpc.

The observed luminosity function can be constructed in a range of absolute integrated magnitudes $I_{M_V} = [-10, -0.5]$ mag, i.e. about 5 magnitudes deeper than in the most nearby galaxies. It increases linearly from the brightest limit to a turnover at about $I_{M_V} \approx -2.5$. The slope of this linear portion is $a = 0.41 \pm 0.01$, which is in perfect agreement with the slope deduced for star cluster observations in nearby galaxies. The masses of the Galactic clusters span a range from a few $M_\odot$ to $\log M_c/M_\odot \approx 5.5$. The mass function of these clusters can be fit as a linear function with log-mass for $\log M_c/M_\odot > 2.5$, and shows a broad maximum between $\log M_c/M_\odot = 1.5$ and 2.5. For $\log M_c/M_\odot > 2.5$, the linear part of the upper cluster mass function has a slope $\alpha = 2.03 \pm 0.05$, again in agreement with data on extragalactic clusters. We regard this agreement as indirect evidence that the tidal masses for Galactic clusters and the luminosity-based masses for extragalactic clusters are on the same scale. Considering now the evolution of the cluster mass function reveals a slight but significant steepening of the slope with increasing age from $\alpha = 1.66 \pm 0.14$ at $\log t <= 6.9$ to $\alpha = 2.13 \pm 0.08$ at $\log t <= 8.5$. This indicates that open clusters are formed with a flatter (initial) mass distribution than the overall observed cluster mass distribution averaged over all ages. Interestingly, the luminosity function of open clusters does not show such a systematic steepening with age as the mass function does.

We find that the initial mass function of open clusters (CIMF) has a two-segment structure with the slopes $\alpha = 1.66 \pm 0.14$ in the range $\log M_c/M_\odot = 3.37 \ldots 4.93$ and $\alpha = 0.82 \pm 0.14$ in the range $\log M_c/M_\odot = 1.7 \ldots 3.37$. The average mass of open clusters at birth is $4.5 \cdot 10^3\, M_\odot$, which should be compared to the average observed mass of about $700\, M_\odot$. The average cluster formation rate derived from the comparison of initial and observed mass functions is $\bar{\upsilon} = 0.4$ kpc^{-2}Myr^{-1}. Multiplying by the age of the Galactic disk (T = 13 Gyr) the predicted surface density of Galactic disk field stars originating from dissolved open clusters amounts to $22\, M_\odot\, \mathrm{pc}^{-2}$ which is about 40%

of the total surface density of the Galactic disk in the Solar Neighbourhood. Thus, we conclude that almost half of all field stars were born in open clusters, a much higher fraction that previously thought.

keywords: Galaxy: disk – Galaxy: open clusters and associations: general – Solar Neighbourhood – Galaxy: stellar content – Galaxies: star clusters

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Variable Stars in the Field of the Open Cluster NGC 2204

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We present the results of a variable stars search in the field of the old open cluster NGC 2204. Five new variables were found, four of them being eclipsing binaries. The sample includes a detached binary located at the turnoff, a W UMa-type system, and an interesting detached low-mass binary with a period of 0.45 d which, however, is a foreground object. We provide V-light curves and finder charts for all variables together with color-magnitude diagrams of the cluster. For four variables incomplete I-light curves are also provided.

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Mass functions and photometric binaries in nine open clusters

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Using homogeneous CCD photometric data from the 105-cm Kiso Schmidt telescope covering a 50' x 50' field, we study the mass functions (MFs) of nine open clusters. The ages and Galactocentric distances of the target clusters vary from 16 - 2000 Myr and 9-10.8 kpc, respectively. The values of MF slopes vary from -1.1 to -2.1. The classical value derived by Salpeter (1955) for the slope of the IMF is $\Gamma = -1.35$. The MFs in the outer regions of the clusters are found to be steeper than in the inner regions, indicating the presence of mass segregation in the clusters.The MF slopes (in the outer region as well as the whole cluster) undergo an exponential decay with the evolutionary parameter τ (= age/ relaxation time). It seems that the evaporation of low-mass members from outer regions of the clusters is not significant at larger Galactocentric distances. It is concluded that the initial mass function (IMF) in the anticentre direction of the Galaxy might have been steeper than the IMF in the opposite direction. A comparison of the observed CMDs of the clusters with synthetic CMDs gives a photometric binary content of $\sim$40%.

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Spitzer Space Telescope evidence in NGC 6791: no super-mass-loss at super-solar metallicity to explain helium white dwarfs?

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We use archival *Spitzer* Space Telescope photometry of the old, super-solar metallicity massive open cluster NGC 6791 to look for evidence of enhanced mass loss, which has been postulated to explain the optical luminosity function and low white dwarf masses in this benchmark cluster. We find a conspicuous lack of evidence for prolificacy of circumstellar dust production that would have been expected to accompany such mass loss. We also construct the optical and infrared luminosity functions, and demonstrate that these fully agree with theoretical expectations. We thus conclude that there is no evidence for the mass loss of super-solar metallicity red giants to be sufficiently high that they can avoid the helium flash at the tip of the red giant branch.

To appear in : Astrophysical Journal Letters
For preprints, contact `jacco@astro.keele.ac.uk`
Also available from the URL
or by anonymous ftp at

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3. Galactic Center Clusters

A Hybrid N-Body Code Incorporating Algorithmic Regularization and Post-Newtonian Forces

Stefan Harfst([1]), Alessia Gualandris([2]), David Merritt([2]), Seppo Mikkola([3])
1) Astronomical Institute 'Anton Pannekoek', University of Amsterdam, the Netherlands, 2) CCRG, Rochester Institute of Technology, Unites States, 3) Tuorla Observatory, Turku University, Finland

We describe a novel N-body code designed for simulations of the central regions of galaxies containing massive black holes. The code incorporates Mikkola's 'algorithmic' chain regularization scheme including post-Newtonian terms up to PN2.5 order. Stars moving beyond the chain are advanced using a fourth-order integrator with forces computed on a GRAPE board. Performance tests confirm that the hybrid code achieves better energy conservation, in less elapsed time, than the standard scheme and that it reproduces the orbits of stars tightly bound to the black hole with high precision. The hybrid code is applied to two sample problems: the effect of finite-N gravitational fluctuations on the orbits of the S-stars; and inspiral of an intermediate-mass black hole into the galactic center.

Accepted by : Monthly Notices of the Royal Astronomical Society
For preprints, contact `harfst@science.uva.nl`
Also available from the URL `http://arxiv.org/abs/arXiv:0803.2310`
or by anonymous ftp at `ftp://`

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4. Galactic Globular Clusters

Stellar Exotica in 47 Tucanae

Christian Knigge ([1]), Andrea Dieball ([1]), Jesus Maiz Apellaniz ([2]), Knox S. Long ([3]), David R. Zurek ([4]), Michael M. Shara ([4])
(1) University of Southampton, (2) IAA-CSIC, (3) STSCI, (4) AMNH

We present far-ultraviolet (FUV) spectroscopy obtained with the Hubble Space Telescope (HST) for 48 blue objects in the core of 47 Tuc. Based on their position in a FUV-optical colour-magnitude diagram, these were expected to include cataclysmic variables (CVs), blue stragglers (BSs), white dwarfs (WDs) and other exotic objects. For a subset of these sources, we also construct broad-band, FUV through near-infrared spectral energy distributions. Based on our analysis of this extensive data set, we report the following main results. (1) We detect emission lines in three previously known or suspected CVs and thus spectroscopically confirm the status of these systems. We also detect new dwarf nova eruptions in two of these CVs. (2) Only one other source in our spectroscopic sample exhibits marginal evidence for line emission. Thus CVs are not the only class of objects found in the gap between the WD and main sequences, nor are they common amongst objects near the top of the WD cooling sequence. Nevertheless, predicted and observed numbers of CV agree to within a factor of about 2-3. (3) We have discovered a hot (T_{eff} = 8700 K), low-mass (M = 0.05 $M_{\odot}$) secondary star in a previously known 0.8-day binary system. This exotic object completely dominates the binary's FUV-NIR output and is probably the remnant of a subgiant that has been stripped of its envelope. Since this object must be in a short-lived evolutionary state, it may represent the "smoking gun" of a recent dynamical encounter. (4) We have found a Helium WD, only the second such object to be optically detected in 47 Tuc, and the first outside a millisecond pulsar system. (5) We have discovered a bright BS with a young WD companion, the only BS-WD binary known in any GC. (6) We have found two additional candidate WD binary systems, one containing a MS companion, the other containing a subgiant. (7) We estimate the WD binary fraction in the core of 47 Tuc to be 15 +17/-9 (stat) +8/-7 (sys) per cent. (8) The mass of the optically brightest BS in our sam ple may exceed twice the cluster turn-off mass, but the uncertainties are too large for this to be conclusive. Thus there is still no definitive example of such a "supermassive" BS in any GC. Taken as a whole, our study illustrates the wide range of stellar exotica that are lurking in the cores of GCs, most of which are likely to have undergone significant dynamical encounters.

Accepted by : Astrophysical Journal
For preprints, contact `christian@astro.soton.ac.uk`
Also available from the URL `http://`
or by anonymous ftp at `ftp://`

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Arp 2 and Terzan 8: a detailed chemical analysis

M. Mottini[1], G. Wallerstein[1] and A. McWilliam[2]
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To compare the globular clusters associated with the Sagittarius Galaxy we report the results obtained from new high resolution spectra of red giant stars in Terzan 8 and Arp 2, collected with the Magellan echelle spectrograph (MIKE) at Las Campanas Observatory. For Ter 8 we find [FeI/H]=[FeII/H]-2.32 ± 0.07, while for Arp 2 [FeI/H]$=-1.78\pm0.04$ and [FeII/H]$=-1.94\pm0.07$. Other elements usually of interest show the following results. For oxygen we obtain [O/Fe]$=0.67\pm0.16$ for Ter 8 and [O/Fe]$=0.28\pm0.22$ for Arp 2. For the α-elements (Mg, Si, Ca, Ti) the mean values are 0.35 ± 0.14 dex for Ter 8 and 0.33 ± 0.11 for Arp 2. These values are not too different from the Galactic globular clusters at a similar [Fe/H] value. The heavy s-process elements Ba and Nd show no excesses in Ter 8 and in Arp 2. Our only r-process element, Eu, shows an excess of 0.53 dex in Arp 2, based on the only useful line at 6645 Å.

Submitted to:
For preprints, contact marta@astro.washington.edu

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5. Dynamical evolution - Simulations

The influence of initial mass segregation on the runaway merging of stars

Eliani Ardi ([1]), Holger Baumgardt ([2]), Shin Mineshige ([3])
([1]) Kyoto International University, ([2]) AIfA, Bonn University, ([3]) Yukawa Institute, Kyoto University

We have investigated the effect of initial mass segregation on the runaway merging of stars. The evolution of multi-mass, dense star clusters was followed by means of direct N-body simulations of up to 131.072 stars. All minimum mass of a certain fraction of stars whose either (1) distances were closest to the cluster center or (2) total energies were lowest. The second case is more favorable to promote the runaway merging of stars by creating a high-mass core of massive, low-energy stars. Initial mass segregation could decrease the central relaxation time and thus help the formation of a high-mass core. However, we found that initial mass segregation does not help the runaway stellar merger to happen if the overall mass density profile is kept constant. This is due to the fact that the collision rate of stars is not increased due! to initial mass segregation. Our simulations show that initial mass segregation is not sufficient to allow runaway merging of stars to occur in clusters with central densities typical for star clusters in the Milky Way.

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For preprints, contact `eliani@yukawa.kyoto-u.ac.jp`
Also available from the URL `http://de.arxiv.org/abs/0804.2299`
or by anonymous ftp at `ftp://`

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An alternative method to study star cluster disruption

M. Gieles ([1]) & N. Bastian ([2])
([1]) ESO/Santiago ([2]) IoA, Cambridge

Many embedded star clusters do not evolve into long-lived bound clusters. The most popular explanation for this "infant mortality" of young (few Myrs) clusters is the expulsion of natal gas by stellar winds and supernovae, which perturbs the clusters' potential and leaves up to 90% of them unbound. A cluster disruption model has recently been proposed in which this mass-independent disruption of clusters proceeds for another Gyr after gas expulsion. In this scenario, the survival chances of massive clusters are much smaller than in the traditional mass-dependent disruption models. The most common way to study cluster disruption is to use the cluster age distribution, which, however, can be heavily affected by incompleteness. To avoid this pitfall we introduce a new method of studying cluster disruption based on size-of-sample effects, namely the relation between the most massive cluster, M_{max}, and the age range sampled. Assuming that clusters are stochastically sampled from a power-law cluster initial mass function, with index -2 and that the cluster formation rate is constant, M_{max} scales with the age range sampled, such that the slope in a $\log(M_{max})$ vs. log(age) plot is equal to unity. This slope decreases if mass-independent disruption is included. For 90% mass-independent cluster disruption per age dex, the predicted slope is zero. For the solar neighbourhood, SMC, LMC, M 33, and M 83, based on ages and masses taken from the literature, we find slopes consistent with the expected size-of-sample correlations for the first 100 Myr, hence ruling out the 90% mass-independent cluster disruption scenario. For M 51, however, the increase of $\log(M_{max})$ with log(age) is slightly shallower and for the Antennae galaxies it is flat. This simple method shows that the formation and/or disruption of clusters in the Antennae must have been very different from that of the other galaxies studied here, so it should not be taken as a representative case.

To appear in : 2008, A&A, 482, 165 / arXiv:0802.3387
For preprints, contact `mgieles@eso.org`
Also available from the URL `http://arxiv.org/abs/0802.3387`
or by anonymous ftp at `ftp://`

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The influence of gas expulsion and initial mass-segregation on the stellar mass-function of globular star clusters

Michael Marks, Pavel Kroupa, Holger Baumgardt
Argelander-Institute for Astronomy, Bonn University

Recently de Marchi, Paresce & Pulone (2007) studied a sample of twenty globular clusters and found that all clusters with high concentrations have steep stellar mass-functions while clusters with low concentration have comparatively shallow mass-functions. No globular clusters were found with a flat mass-function and high concentration. This seems curious since more concentrated star clusters are believed to be dynamically more evolved and should have lost more low-mass stars via evaporation, which would result in a shallower mass-function in the low-mass part. We show that this effect can be explained by residual-gas expulsion from initially mass-segregated star clusters, and is enhanced further through unresolved binaries. If gas expulsion is the correct mechanism to produce the observed trend, then observation of these parameters would allow to constrain cluster starting conditions such as star formation efficiency and the time-scale of gas expulsion.

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For preprints, contact `mmarks@astro.uni-bonn.de`
Also available from the URL `http://de.arxiv.org/abs/0803.0543`
or by anonymous ftp at `ftp://`

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The shape of the initial cluster mass function: what it tells us about the local star formation efficiency

Genevieve Parmentier ([1]), Simon Goodwin ([2]), Pavel Kroupa ([3]), Holger Baumgardt ([3])

([1]) IAGL, Liege, Belgium ([2]) University of Sheffield, UK ([3]) AIfA, Bonn, Germany

We explore how the expulsion of gas from star-cluster forming cloud-cores due to supernova explosions affects the shape of the initial cluster mass function, that is, the mass function of star clusters when effects of gas expulsion are over. We demonstrate that if the radii of cluster-forming gas cores are roughly constant over the core mass range, as supported by observations, then more massive cores undergo slower gas expulsion. Therefore, for a given star formation efficiency, more massive cores retain a larger fraction of stars after gas expulsion. The initial cluster mass function may thus differ from the core mass function substantially, with the final shape depending on the star formation efficiency. A mass-independent star formation efficiency of about 20 per cent turns a power-law core mass function into a bell-shaped initial cluster mass function, while mass-independent efficiencies of order 40 per cent preserve the shape of the core mass function.

Accepted by : Astrophysical Journal
For preprints, contact `gparmentier@ulg.ac.be`
Also available from the URL `http://de.arxiv.org/abs/0802.1452`
or by anonymous ftp at `ftp://`

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Dynamical evolution of the mass function and radial profile of the Galactic globular cluster system

Jihye Shin([1]), Sungsoo S. Kim([1]), Koji Takahashi([2])
(1) Kyung Hee University, Korea; (2) Saitama Institute of Technology, Japan

Evolution of the mass function (MF) and radial distribution (RD) of the Galactic globular cluster (GC) system is calculated using an advanced and a realistic Fokker-Planck (FP) model that considers dynamical friction, disc/bulge shocks and eccentric cluster orbits. We perform hundreds of FP calculations with different initial cluster conditions, and then search a wide-parameter space for the best-fitting initial GC MF and RD that evolves into the observed present-day Galactic GC MF and RD. By allowing both MF and RD of the initial GC system to vary, which is attempted for the first time in the present Letter, we find that our best-fitting models have a higher peak mass for a lognormal initial MF and a higher cut-off mass for a power-law initial MF than previous estimates, but our initial total masses in GCs, $M_{T,i} = 1.5 - 1.8 \cdot 10^8$ Msun, are comparable to previous results. Significant findings include that our best-fitting lognormal MF shifts downward by 0.35 dex during the p! eriod of 13 Gyr, and that our power-law initial MF models well-fit the observed MF and RD only when the initial MF is truncated a$t > \sim 10^5$ Msun. We also find that our results are insensitive to the initial distribution of orbit eccentricity and inclination, but are rather sensitive to the initial concentration of the clusters and to how the initial tidal radius is defined. If the clusters are assumed to be formed at the apocentre while filling the tidal radius there, $M_{T,i}$ can be as high as $6.9 \cdot 10^8$ Msun, which amounts to $\sim$75 per cent of the current mass in the stellar halo.

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For preprints, contact `sungsoo.kim@khu.ac.kr`
Also available from the URL `http://arxiv.org/abs/0805.0058`
or by anonymous ftp at `ftp://`

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6. Miscellaneous

The Dartmouth Stellar Evolution Database

Aaron Dotter, Brian Chaboyer, Darko Jevremovic, Veselin Kostov, E. Baron, & Jason W. Ferguson
Dartmouth College Astronomical Observatory, Belgrade University of Oklahoma Wichita State University

The ever-expanding depth and quality of photometric and spectroscopic observations of stellar populations increase the need for theoretical models in regions of age-composition parameter space that are largely unexplored at present. Stellar evolution models that employ the most advanced physics and cover a wide range of compositions are needed to extract the most information from current observations of both resolved and unresolved stellar populations. The Dartmouth Stellar Evolution Database is a collection of stellar evolution tracks and isochrones that spans a range of [Fe/H] from -2.5 to +0.5, [alpha/Fe] from -0.2 to +0.8 (for [Fe/H] <= 0) or +0.2 (for [Fe/H] > 0), and initial He mass fractions from Y=0.245 to 0.40. Stellar evolution tracks were computed for masses between 0.1 and 4 Msun, allowing isochrones to be generated for ages as young as 250 Myr. For the range in masses where the core He flash occurs, separate He-burning tracks were computed starting from the zero age horizontal branch. The tracks and isochrones have been transformed to the observational plane in a variety of photometric systems including standard UBV(RI)c, Stromgren uvby, SDSS ugriz, 2MASS JHKs, and HST ACS-WFC and WFPC2. The Dartmouth Stellar Evolution Database is accessible through a website where all tracks, isochrones, and additional files can be downloaded.

Accepted by : Astrophysical Journal Supplement Series
For preprints, contact `aaron.dotter@dartmouth.edu`
Also available from the URL `http://stellar.dartmouth.edu/~models/`
or by anonymous ftp at

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What determines the mass of the most massive star cluster in a galaxy: statistics, physics or disruption?

M. Gieles ([1])
([1]) ESO/Santiago

In many different galactic environments the cluster initial mass function (CIMF) is well described by a power-law with index -2. This implies a linear relation between the mass of the most massive cluster (M_{max}) and the number of clusters. Assuming a constant cluster formation rate and no disruption of the most massive clusters it also means that M_{max} increases linearly with age when determining M_{max} in logarithmic age bins. We observe this increase in five out of the seven galaxies in our sample, suggesting that M_{max} is determined by the size of the sample. It also means that massive clusters are very stable against disruption, in disagreement with the mass independent disruption (MID) model presented at this conference. For the clusters in M51 and the Antennae galaxies the size-of-sample prediction breaks down around 10^6 $M_\odot$, suggesting that this is a physical upper limit to the masses of star clusters in these galaxies. In this method there is a degeneracy between MID and a CIMF truncation. We show how the cluster luminosity function can serve as a tool to distinguish between the two.

To appear in : 6 pages, 3 figures, to appear in "Young Massive Star Clusters - Initial Conditions and Environments", 2008, Astrophysics & Space Science, eds. E. Perez, R. de Grijs, R. M. Gonzalez Delgado
For preprints, contact `mgieles@eso.org`
Also available from the URL `http://arxiv.org/abs/0801.2676`
or by anonymous ftp at `ftp://`

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New catalogue of optically visible open clusters and candidates - version 2.9 (2008)

W. S. Dias, A. Moitinho, J. R. D. Lépine and B. S. Alessi

We are pleased to announce that the most recent version (2.9) of the DAML02 Catalogue is available online. In this new edition (version 2.9), we included 11 new open cluster candidates in the database. Virtually all papers published after the version 2.8 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. The complete statistical information is:

Number of clusters: 1776
Clusters with Diameters: 1774 (99.89%)
Clusters with Distances: 1082 (60.92%)
Clusters with Reddening: 1061 (59.74%)
Clusters with Ages: 949 (53.43%)
Clusters with Dist,Redd. and Ages: 936 (52.70%)
Clusters with Proper motions: 890 (50.11%)
Clusters with Radial velocities: 447 (25.17%)
Clusters with P.Motions + RVs: 432 (24.32%)
Clusters with Dist,Ages,PMS and RVs 379 (21.34%)
Clusters with Abundances: 158 (8.90%)

This catalogue is being constantly updated and maintained in electronic form for the widest possible accessibility. The latest version (2.9) 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 catalog, 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 catalog has been used and cited in more than 100 papers. Like in the past more than one catalog 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.

First Announcement

"The N-Body Problem: Numerical Methods and Applications"

August 10-14, 2008, Turku, Finland

The meeting is dedicated to discuss the latest developments in computational N-body dynamics and will be held from August 10 - 14 in Turku, Finland.

The meeting will combine a workshop with a school for young researchers. The aim of the school is to educate students and postdocs working in the fields of N-body simulations and numerical relativity on the newest approaches and results in computational dynamics and their applications.

The school will consist of invited lectures and a limited number of oral presentations. Roughly half a dozen senior lecturers, all experts in their respective fields, will deliver 2-4 hours each of pedagogical talks. Topics to be discussed include:

- N-Body Algorithms
- Regularization of Motion in the N-Body Problem
- Relativistic Terms
- Special-Purpose Hardware / Parallel Computing
- The Three-Body Problem
- Dynamical Evolution of Star Clusters
- Galactic Nuclei (including the Milky Way)

Confirmed speakers include S. Aarseth, H. Baumgardt, K. Tanikawa, D. Merritt, S. Mikkola, and S. Portegies Zwart.

Students at the advanced masters or PhD level, as well as postdocs, are invited to apply. Approximately 25-30 junior participants will be selected. For details on the application process, please see

http://www.astro.utu.fi/conf/NBody2008/

We hope to be able to waive registration fees for the junior participants. We anticipate that additional funding will become available to help offset local expenses for the junior participants as well.

Senior researchers are also invited to apply, and to propose talks. We anticipate that approximately two talks per day will be scheduled in addition to the pedagogical talks.

Please feel free to contact us directly if you have questions. On behalf of the SOC

David Merritt (merritt@astro.rit.edu) and Aleksandr Myllari (amyllari@gmail.com)

First Announcement

Star Clusters - Witnesses of Cosmic History
September 8-12, 2008, Vienna, Austria

Dear colleagues,

this is the first announcement for a splinter meeting on "Star Clusters - Witnesses of Cosmic History" to be hosted during the Joint European and National Astronomy Meeting 2008 in Vienna (JENAM 2008) conference as Symposium No.5.
The Joint European and National Astronomy Meeting 2008 (JENAM 2008) will be held on September 8-12, 2008 in Vienna, Austria, as the joint meeting of the Austrian Society of Astronomy and Astrophysics (OEGAA), the Astronomische Gesellschaft (AG), and the European Astronomical Society (EAS). It will be hosting nine symposia under the overall topic "New Challenges To European Astronomy", including Symposium No.5 on "Star Clusters - Witnesses of Cosmic History".
Details for the main conference may be found at

http://www.univie.ac.at/jenam2008/

information specific to the "Star Clusters - Witnesses of Cosmic History" Symposium at

http://www.univie.ac.at/webda/minisymposium.html/

If you would like to attend the Symposium, we invite you to register for the main conference before **May 31 2008** (see details at the webpages above, or attached below). Second and further announcements will only be sent to registered participants.

On behalf of the SOC, best regards,

Ernst Paunzen, Rainer Spurzem, Pavel Kroupa and Holger Baumgardt

Registration and Abstract submission

The registration for the conference and the abstract submission must both be done through the registration system on the JENAM 2008 conference server, accessible through the main conference website of the Joint European and National Astronomy Meeting 2008 in Vienna at http://www.univie.ac.at/jenam2008/
Registration is open until **May 31 2008.**

Abstract deadline for "Short Contributions" (both oral and poster) is May 31 2008; this includes all proposed contributions for the Symposium "Star Clusters - Witnesses of Cosmic History" - please indicate the appropriate Symposium for your proposed contribution upon submission.

Scientific Organising Committee

Roberto Capuzzo-Dolcetta, University of Rome
Francesco R. Ferraro, Bologna University
Douglas C. Heggie, University of Edinburgh
Michael Hilker, ESO
Steffen Mieske, ESO

Scientific rationale:

Star clusters are ubiquitous and cover a wide range of sizes, masses, ages, and metallicities. The ages and chemical composition of the oldest clusters provide a fossil record of galaxy evolution, and they could recently be traced for the first time in cosmological simulations. Globular Cluster systems around external galaxies, although not observable on a star-by-star basis, provide excellent probes of star cluster evolution and the role of internal and external processes, as well as on the merging and star formation history of the parent galaxy, by analysis of different cluster generations. Globular star clusters in the Local Group are increasingly resolved into individual stars, allowing us to study their chemical and dynamical evolution in much detail providing important constraints for theoretical modelling by direct N-body or approximate modelling. Furthermore, star clusters are evolving systems. Dynamical processes strongly influence the evolution of their stellar populations and are the main drivers for the formation of many exotic, still poorly understood objects (such as blue stragglers, X-ray binaries, millisecond pulsars, and possibly black holes). The wealth of detailed spectral and colour information obtained with modern ground- and space-based instruments reveals an even further complexity in colour-magnitude diagrams, which raise new questions regarding stellar evolution, chemistry and mixing in stars, self-enrichment and the age spread of stars within star clusters.

Our symposium is envisaged to last for 2-3 days, providing a balance between cosmological, extragalactic and galactic star clusters as well as between observational and theoretical papers. Preference will be given to those talks and contributions which promote the understanding of generic properties and evolution of globular star clusters, which help in providing a global picture of the physics of such objects.

Program

The program will include the following topics:

- Star Clusters in Cosmological Models / First Star Clusters
- Extragalactic Cluster Systems, Cluster Populations
- Nuclear Star Clusters
- Local Group Star Clusters - Theory and Modelling
- Galactic Globular Clusters
- Young Forming Star Cluster

Practical information on Travel and Accomodation

Please refer to the main conference website of the Joint European and National Astronomy Meeting 2008 in Vienna for all questions on how to travel to Vienna, where to stay, and how to get to the conference location and around, as well as for information on social and cultural events.

PhD Scholarship at the Observatoire astronomique de Strasbourg

High-resolution modelling of the Milky Way centre and its Black Hole

Application deadline: 15 May 2008
Start date: 1 October 2008 (three-year programme)

Project description:
The PhD candidate will focus his or her research on the issue of discovering the origin of the stellar spatial distribution and kinematics about the Milky Way centre, both in terms of light profiling and stellar population. Both analytical and numerical aspects will be investigated. The candidate will first get acquainted with the stability analysis of Poisson-Boltzmann equations (distribution functions, moments, perturbations). Growth rates of perturbation modes stemming from a non-static black hole mass will allow to map out the response of stars in phase-space and derive observables in relation to the characteristics of the black hole mass. The kinematics of massive stars will be explored and mapped out for comparison with RAVE data. These analytical predictions will be validated with numerical N-body rendering of a self-gravitating system to determine whether the black hole may have undergone a recent episode of mass accretion.

The evolution of rich stellar populations (including binary stars and a full stellar mass spectrum) with star-by-star N-body models will be put to task in order to assess the role of the migration of massive stars toward the centre, down to the break off radius ~ 0.2 pc. Colour indices recovered from available stellar spectral libraries and evolutionary tracks will be compared with observational constraints to determine whether stars were more likely formed in situ. The public-domain codes Phi-Grape and Nobdy6++ running on a parallel-platform Grape/GPU computer cluster will be dedicated to this task.

Logistics:
The Observatoire has secured a four-node 8-processor computer cluster equipped with Grape6-BLX64 cards and Nvidia 8600GTX graphics cards for dedicated computing of gravitational dynamics with direct-summation and particle-mesh codes. The SIMPSON cluster of four Pentium D950 dual-processor computers was acquired in the Autumn of 2007 as part of the SING research programme funded by the University of Strasbourg. The Observatoire also has proprietary access to eight dual-processor general purpose computers at the University's Centre for Computing and Visualisation facilities, which provides access to a still-growing computer cluster of eighty dual-processor machines on a shared-time basis. The candidate will be given full access to these facilities. Computing time on national supercomputing facilities such as IDRIS will be sought as required.

Candidates whose native language is not French will be able to submit a PhD thesis written in English. No course work will be required, however enrollment to specialised courses or schools (Master's or Doctoral level) will be encouraged. The International Space University or the European Doctoral College offer courses of general interest to space sciences in the English medium (see urls HTTP://WWW.ISUNET.EDU/ and HTTP://EDC.U-STRASBG.FR/EDC/ABOUT/INDEX_ENG.HTML).

The Observatoire astronomique:
The Observatoire Astronomique is an independent faculty federated to the University of Strasbourg since 1973. Research at the Observatoire astronomique covers three broad areas, namely High Energy astrophysics; Galaxies; and Stellar populations, with theoretical and observational astronomy given equal weight; the url HTTP://ASTRO.U-STRASBG.FR/OBSERVATOIRE/ provides some basic information about its history and general setup. The group Galaxies (team-leader R. Ibata) was setup in 2000 with a view to spear-head research programmes in the fields of galactic and extra-galactic astronomy. The team members have since motored a broad range of scientific activities which led to 198 refereed articles totalling over 4600 citations (65 first-author papers accounting for 1575 citations). Today the group consists of 10 permanent staff (among whom Aubert, Bienaymé, Boily, Halbwachs, Ibata and Lançon work on some aspect of the PhD project) incremented by regular in-house research collaborations (Allen, Cambresy, Siebert, Vollmer). There are currently 4 students pursuing a PhD degree within the group; recent PhD awardees include

J-J.Fleck, N.Martin, M.Mouhcine, P.Ocvirk and L.Veltz. Master's degree-level assistantships as well as summer traineeships are commonly offered to students from all across Europe. A RAVE post-doctoral fellow will join the group for an initial period of two years starting in the Autumn. The expertise developed in the team includes observational campaigns regularly awarded observing time on world-class telescopes (Keck, VLT, HST...) as well as theoretical astrophysics with a focus on gravitational dynamics and stellar populations. An international conference recently took place in Strasbourg on the topic of galactic and stellar dynamics (see URL HTTP://ASTRO.U-STRASBG.FR/SCYON/GSD2008.HTML).

How to apply:
Candidates should hold a Master's degree in Astrophysics or Computational Sciences, or equivalent experience. Application material include a letter of motivation, a full C.V., copies of degrees obtained or expected, as well as two letters of recommendation to be sent under separate cover to

Christian Boily, Observatoire astronomique, 11 rue de l'Université, Strasbourg F-67000, France.

Scanned material in pdf or ps format and informal inquiries can be forwarded by email (see addresses below). The deadline to receive all application material is 15 May 2008. Applications received after that date may not be given full consideration.

Contact addresses {aubert,cmb}@astro.u-strasbg.fr

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