$\mathcal{SCYON}$

The Star Clusters Young & Old Newsletter

edited by Holger Baumgardt, Ernst Paunzen and Pavel Kroupa

SCYON can be found at URL:
`http://astro.u-strasbg.fr/scyon`

SCYON Issue No. 31 *11 December 2006*

EDITORIAL

Here is the 31st issue of the SCYON newsletter. The current issue contains 35 abstracts, an announcement for a new, parallel N-body code and announcements for conferences in Italy, Germany and Armenia. It also contains job advertisements for postdoctoral and tenure track positions from Rochester Institute of Technology.

We wish everybody a merry holiday season and a happy new year 2007 and thank those who sent us their contributions.

Holger Baumgardt, Ernst Paunzen and Pavel Kroupa

CONTENTS

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/)

---

1. Star Forming Regions

Current Star Formation in the Perseus Molecular Cloud: Constraints from Unbiased Submillimeter and Mid-Infrared Surveys

Jes K. Jørgensen ([1]), Doug Johnstone ([2,3]), Helen Kirk ([3,2]), & Philip C. Myers ([1])

([1]) Harvard-Smithsonian Center for Astrophysics, 60 Garden Street MS42, Cambridge, MA 02138, USA, (2) Herzberg Institute of Astrophysics, National Research Council of Canada, 5071 West Saanich Road, Victoria, BC V9E 2E7, Canada, (3) Department of Physics & Astronomy, University of Victoria, Victoria, BC, V8P 1A1, Canada

We present a census of the population of deeply embedded young stellar objects (YSOs) in the Perseus molecular cloud complex based on a combination of Spitzer Space Telescope mid-infrared data from the "Cores to Disks" (c2d) legacy team and JCMT/SCUBA submillimeter maps from the COMPLETE team. The mid-infrared sources detected at 24 μm and having $[3.6]-[4.5] > 1$ are located close to the center of the SCUBA cores, typically within $15''$ of their peaks. The narrowness of the spatial distribution of mid-infrared sources around the peaks of the SCUBA cores suggests that no significant dispersal of the newly formed YSOs has occurred. This argues against the suggestion that motions of protostars regulate the time scales over which significant (Bondi-Hoyle) accretion can occur. The YSOs are found to have red $[3.6]-[4.5]$ and $[8.0]-[24]$ colors, but not comparable red $[5.8]-[8.0]$ colors. The most deeply embedded YSOs are found in regions with high extinction, $A_V \geq 5$, similar to the extinction threshold observed for the SCUBA cores. All the SCUBA cores with high concentrations have embedded YSOs, but not all cores with low concentrations are starless. From the above considerations a relatively unbiased sample of 49 deeply embedded YSOs is constructed. Embedded YSOs are found in 40 of the 72 SCUBA cores with only three cores harboring multiple embedded YSOs within $15''$. The equal number of SCUBA cores with and without embedded YSOs suggests that the time scale for the evolution through the dense prestellar stages, where the cores are recognized in the submillimeter maps and have central densities of $5 \times 10^4 - 1 \times 10^5 \sim \mathrm{cm}^{-3}$, is similar to the time scale for the embedded protostellar stages. The current star formation efficiency of cores is estimated to be approximately 10–15%. In contrast, the star formation efficiency averaged over the cloud life time and compared to the total cloud mass is only a few percent, reflecting also the efficiency in assembling cloud material into the dense cores actually forming stars.

To appear in : (astro-ph/0610381)

For preprints, contact `jjorgensen@cfa.harvard.edu`

Also available from the URL `http://arxiv.org/abs/astro-ph/0610381`

or by anonymous ftp at

.....

A kinematic study of the Taurus-Auriga T association

Claude Bertout & Francoise Genova
Institut d'Astrophysique de Paris Observatoire de Strasbourg

Aims: This is the first paper in a series dedicated to investigating the kinematic properties of nearby associations of young stellar objects. Here we study the Taurus-Auriga association, with the primary objective of deriving kinematic parallaxes for individual members of this low-mass star-forming region. Methods: We took advantage of a recently published catalog of proper motions for pre-main sequence stars, which we supplemented with radial velocities from various sources found in the CDS databases. We searched for stars of the Taurus-Auriga region that share the same space velocity, using a modified convergent point method that we tested with extensive Monte Carlo simulations. Results: Among the sample of 217 Taurus-Auriga stars with known proper motions, we identify 94 pre-main sequence stars that are probable members of the same moving group and several additional candidates whose pre-main sequence evolutionary status needs to be confirmed. We derive individual parallaxes for the 67 moving group members with known radial velocities and give tentative parallaxes for other members based on the average spatial velocity of the group. The Hertzsprung-Russell diagram for the moving group members and a discussion of their masses and ages are presented in a companion paper.

Accepted by : Astronomy & Astrophysics
For preprints, contact
Also available from the URL `http://arxiv.org/abs/astro-ph/0610506`
or by anonymous ftp at `ftp://`

.....

The Galactic distribution of magnetic fields in molecular clouds and HII regions

J.L. Han ([1]) J.S. Zhang ([2,3])
[1]. NAOC [2]. GuangZhou Univ. [3]. PMO

Aims: Magnetic fields exist on all scales in our Galaxy. There is a controversy on whether the magnetic fields in molecular clouds are preserved from the permeated magnetic fields in the interstellar medium (ISM). We want to check this controversy using available data in the light of the newly revealed magnetic field structure of the Galactic disk obtained from pulsar rotation measures (RMs). Methods: We collected the measurements of the magnetic fields in molecular clouds, including Zeeman splitting data of OH masers in clouds and OH or HI absorption or emission lines of clouds themselves. Results: These Zeeman data show structures in the sign distribution of line-of-sight component of magnetic field. Comparing with the large- scale Galactic magnetic fields from pulsar RMs we found that the sign-distribution show similar large-scale field reversals. Previous such examinations were flawed by the over-simplified global model for the large-scale magnetic fields in the Galactic disk. Conclusions: We conclude that the magnetic fields in the clouds may still "remember" the directions of magnetic fields in the Galactic ISM to some extent, and could be used as completementary tracer for the large-scale magnetic structure. More Zeeman data of OH masers in widerly distributed clouds are desired for such a study.

Accepted by : Astronomy & Astrophysics
For preprints, contact `hjl@bao.ac.cn`
Also available from the URL `http://arxiv.org/abs/astro-ph/0611213`
or by anonymous ftp at `ftp://`

.....

A brown dwarf desert for intermediate mass stars in Sco OB2?

Thijs Kouwenhoven (Sheffield), Anthony Brown (Leiden), and Lex Kaper (Amsterdam)

We present JHK observations of 22 intermediate-mass stars in the Scorpius-Centaurus OB association, obtained with VLT/NACO. This survey was performed to determine the status of (sub)stellar candidate companions of Sco OB2 member stars of spectral type A and late-B. The distinction between companions and background stars is made on the basis of a comparison to isochrones and additional statistical arguments. We are sensitive to companions with an angular separation of 0.1"-11" (13-1430 AU) and the detection limit is K=17 mag. We detect 62 stellar components of which 18 turn out to be physical companions, 11 candidate companions, and 33 background stars. Three of the 18 confirmed companions were previously undocumented as such. The companion masses are in the range 0.03<M<1.19 Msun, corresponding to mass ratios 0.06<q<0.55. We include in our sample a subset of 9 targets with multi-color ADONIS observations from Kouwenhoven et al. (2005). In the ADONIS survey secondaries with K<12 mag were classified as companions; those with K>12 mag as background stars. The multi-color analysis in this paper demonstrates that the simple K=12 mag criterion correctly classifies the secondaries in ∼80% of the cases. We reanalyse the total sample (i.e. NACO and ADONIS) and conclude that of the 176 secondaries, 25 are physical companions, 55 are candidate companions, and 96 are background stars. Although we are sensitive (and complete) to brown dwarf companions as faint as K=14 mag in the semi-major axis range 130-520 AU, we detect only one, corresponding to a brown dwarf companion fraction of 0.5% (M>30 MJ). However, the number of brown dwarfs is consistent with an extrapolation of the (stellar) companion mass distribution into the brown dwarf regime. This indicates that the physical mechanism for the formation of brown dwarf companions around intermediate mass stars is similar to that of stellar companions, and that the embryo ejection mechanism does not need to be invoked in order to explain the small number of brown dwarf compan ions among intermediate mass stars in Sco OB2.

Accepted by : Astronomy & Astrophysics
For preprints, contact `t.kouwenhoven@sheffield.ac.uk`
Also available from the URL `http://xxx.lanl.gov/abs/astro-ph/0611903`
or by anonymous ftp at `ftp://`

. . . . . .

2. Embedded Clusters

The Spitzer c2d Survey of Nearby Dense Cores: IV. Revealing the Embedded Cluster in B59

Timothy Y. Brooke([1]), Tracy L. Huard([2]), Tyler L. Bourke([2]), A. C. Adwin Boogert([1],[14]), Lori E. Allen([2]), Geoffrey A. Blake([3]), Neal J. Evans, II([4]), Paul M. Harvey([4]), David W. Koerner([5]), Lee G. Mundy([6]), Philip C. Myers([2]), Deborah L. Padgett([7]), Anneila I. Sargent([1]), Karl R. Stapelfeldt([8]), Ewine F. van Dishoeck([9]), Nicholas Chapman([6]), Lucas Cieza([4]), Michael M. Dunham([4]), Shih-Ping Lai([6],[12],[13]), Alicia Porras([2]), William Spiesman([4]), Peter J. Teuben([6]), Chadwick H. Young([10]), Zahed Wahhaj([5]), Chang Won Lee([11])

([1]) Department of Astronomy, Caltech ([2]) SAO ([3]) Department of Geological and Planetary Sciences, Caltech ([4]) Department of Astronomy, University of Texas ([5]) Department of Physics and Astronomy, Northern Arizona University ([6]) Department of Astronomy, University of Maryland ([7]) Spitzer Science Center ([8]) Jet Propulsion Laboratory ([9]) Leiden Observatory ([10]) Department of Physical Sciences, Nicholls State University ([11]) Korea Astronomy and Space Science Institute ([12]) Institute of Astronomy and Department of Physics, National Tsing Hua University ([13]) Academia Sinica Institute of Astronomy and Astrophysics ([14]) NOAO Gemini Science Center

Infrared images of the dark cloud core B59 were obtained with the Spitzer Space Telescope as part of the "Cores to Disks" Legacy Science project. Photometry from 3.6-70 microns indicates at least 20 candidate low-mass young stars near the core, more than doubling the previously known population. Out of this group, 13 are located within roughly 0.1 pc in projection of the molecular gas peak, where a new embedded source is detected. Spectral energy distributions span the range from small excesses above photospheric levels to rising in the mid-infrared. One other embedded object, probably associated with the millimeter source B59-MMS1, with a bolometric luminosity L(bol) roughly 2 L(sun), has extended structure at 3.6 and 4.5 microns, possibly tracing the edges of an outflow cavity. The measured extinction through the central part of the core is A(V) greater than of order 45 mag. The B59 core is producing young stars with a high efficiency.

Accepted by : Astrophysical Journal
For preprints, contact
Also available from the URL `http://arXiv.org/abs/astro-ph/0610797`
or by anonymous ftp at `ftp://`

.....

Pre-main-sequence stars in the Lagoon Nebula (M8)

Julia I. Arias ([1]), Rodolfo H. Barba ([2]), Nidia I. Morrell ([3])

([1]) Facultad de Ciencias Astronomicas y Geofisicas, Universidad Nacional de La Plata, Argentina ([2]) Departamento de Fisica, Universidad de La Serena, La Serena, Chile ([3]) Las Campanas Observatory, La Serena, Chile

We report the discovery of new pre-main sequence (PMS) stars in the Lagoon Nebula (M8) at a distance of 1.25 kpc, based on intermediate resolution spectra obtained with the Boller & Chivens spectrograph at the 6.5-m Magellan I telescope (Las Campanas Observatory, Chile). According to the spectral types, the presence of emission lines and the lithium 6708A absorption line, we are able to identify 27 classical T Tauri stars, 7 weak-lined T Tauri stars and 3 PMS emission objects with spectral type G, which we include in a separated stellar class denominated "PMS Fe/Ge class". Using near-infrared photometry either from 2MASS or from our own previous work we derive effective temperatures and luminosities for these stars and locate them in the Hertzsprung-Russell diagram, in order to estimate their masses and ages. We find that almost all of our sample stars are younger than 3 x 10^6 years and span over a range of masses between 0.8 and 2.5 Mo. A cross-correlation between our spectroscopic data and the X-ray sources detected with the Chandra ACIS instrument is also presented.

Accepted by : Monthly Notices of the Royal Astronomical Society
For preprints, contact `julia@dfuls.cl`
Also available from the URL `http://http://xxx.lanl.gov/abs/astro-ph/0611150`
or by anonymous ftp at `ftp://`

.....

3. Galactic Center Clusters

Suzaku Spectroscopy Study of Hard X-Ray Emission in the Arches Cluster

M. Tsujimoto ([1]) Y. Hyodo ([2]) K. Koyama
([1]) Rikkyo University, Japan ([2]) Kyoto University, Japan

We present the results of a Suzaku study of the Arches cluster. A high S/N spectrum in the 3-12 keV band was obtained with the XIS. We found that the spectrum consists of a thermal plasma, a hard power-law tail, and two Gaussian lines. The plasma component (kT$\sim$2.2 keV) is established from the presence of CaXIX and FeXXV K alpha lines as well as the absence of FeXXVI K alpha line. The two Gaussian lines represent the K alpha and beta lines from iron at lower ionization stages. Both the line centers and the intensity ratio of these two lines are consistent with the neutral iron. The hard power-law tail (index 0.7) was found to have no pronounced iron K edge feature. In comparison with the published Chandra spectra, we conclude that the thermal component is from the ensemble of point-like sources plus thermal diffuse emission concentrated at the cluster center, while the Gaussian and the hard tail components are from the non-thermal diffuse emission extended in a larger scale. In the band-limited XIS images, the distribution of the 7.5-10.0 keV emission resembles that of the 6.4 keV emission. This strongly suggests that the power-law emission is related to the 6.4 and 7.1 keV lines in the underlying physics. We discuss two ideas to explain both the hard continuum and the lines: (1) X-ray photoionization that produces fluorescence lines and the Thomson scattering continuum and (2) non-thermal electron impact ionization of iron atoms and bremsstrahlung continuum. But whichever scenario is adopted, the photon or particle flux from the Arches cluster is too low to account for the observed line and continuum intensity.

Accepted by : Publication of the ASJ
For preprints, contact
Also available from the URL `http://agyo.rikkyo.ac.jp/~tsujimot`
or by anonymous ftp at `ftp://`

. . . . . .

4. Galactic Open Clusters

Investigating star formation in the young open cluster NGC 6383

E. Paunzen, M. Netopil, K. Zwintz
Institut fr Astronomie der Universitt Wien,Trkenschanzstr. 17, A-1180 Wien, Austria

By studying young open clusters, the mechanisms important for star formation over several Myr can be examined. For example, accretion rate as a function of rotational velocity can be investigated. Similarly, sequential star formation triggered by massive stars with high mass-loss rates can be studied in detail. We identified and characterized probable members of NGC 6383, as well as determined cluster parameters. New Stromgren uvby CCD photometry, obtained by us, is presented. This new data, together with Johnson UBV and 2MASS data in the NIR, was used to investigate characteristics of pre- as well as zero age main sequence cluster members. We present Stromgren uvby CCD photometry for 272 stars in the field of NGC 6383 and derive its reddening, E(b-y)=0.21(4)mag, as well as distance, d=1.7(3)kpc from the Sun. Several stars with NIR excess and objects in the domain of the classical Herbig Ae/Be and T Tauri stars were detected. Two previously known variables were identified as rapidly-rotating PMS stars. The field population is clearly separated from the probable members in the color-magnitude diagram. NGC 6383 is a young open cluster, with an age of less than 4 Myr, undergoing continuous star formation. True pre-main sequence members might be found down to absolute magnitudes of +6mag, with a variety of rotational velocities and stellar activities.

Accepted by : Astronomy & Astrophysics
For preprints, contact `ernst.paunzen@univie.ac.at`
Also available from the URL `http://www.arxiv.org/abs/astro-ph/0611304`
or by anonymous ftp at

. . . . . .

CCD photometric search for peculiar stars in open clusters. VIII. King 21, NGC 3293, NGC 5999, NGC 6802, NGC 6830, Ruprecht 44, Ruprecht 115, and Ruprecht 120

M. Netopil([1]), E. Paunzen ([1]), H.M. Maitzen([1]), O.I. Pintado([2]), A. Claret([3]), L.F. Miranda([3]), I.Kh. Iliev([4]), V. Casanova([3])

([1]) Institute of Astronomy, University of Vienna, Tuerkenschanzstrasse 17, 1180 Vienna, Austria ([2]) Departamento de Fisica, Facultad de Ciencias Exactas y Tecnologia, Universidad Nacional de Tucuman, Argentina - Consejo Nacional de Investigaciones Cientificas y Tecnicas de la Republica Argentina ([3]) Instituto de Astrofisica de Andalucia CSIC, Apartado 3004, 18080 Granada, Spain ([4]) Institute of Astronomy, National Astronomical Observatory, P.O. Box 136, BG-4700 Smolyan, Bulgaria

We continue our survey of magnetic chemically peculiar (CP2) stars in galactic open clusters to shed more light on their origin and evolution. To study the group of CP2 stars, it is essential to find these objects in different galactic environments and at a wide range of evolutionary stages. The knowledge of open cluster ages and metallicities can help for finding a correlation between these parameters and the (non-)presence of peculiarities, which has to be taken into account in stellar evolution models. The intermediate band Delta a photometric system samples the depth of the 5200A flux depression by comparing the flux at the centre with the adjacent regions with bandwidths of 110A, to 230A. It is capable of detecting magnetic CP2 and CP4 stars with high efficiency, but also the groups of (metal-weak) lambda Bootis and classical Be/shell stars can be successfully investigated. In addition, it allows the age, reddening, and distance modulus to be determined with appropriate accuracy by fitting isochrones. From the 1677 observed members of the eight open clusters, one Ae and twenty-five CP2 stars were identified. Furthermore nineteen deviating stars are designated as questionable for several reasons. The estimated age, reddening, and distance for the programme clusters were compared with published vales of the literature and discussed in this context. The current paper shows that CP2 stars are continuously present in very young (7Myr) to intermediate age (500Myr) open clusters at distances greater than 2kpc from the Sun.

Accepted by : Astronomy & Astrophysics

For preprints, contact `martin.netopil@univie.ac.at`

Also available from the URL `http://www.arxiv.org/abs/astro-ph/0611173`
or by anonymous ftp at

. . . . . .

Chemical Homogeneity in Collinder 261 and Implications for Chemical Tagging

G.M. De Silva([1]), K.C. Freeman([2]), J. Bland-Hawthorn([3]), M. Asplund([2]), M.S. Bessell([2]), R. Collet([4])

([1]) European Southern Observatory, Alonso de Cordova 3107, Santiago, Chile ([2]) Mount Stromlo Observatory, Australian National University, Weston ACT 2611, Australia ([3]) Anglo-Australian Observatory, Eastwood NSW 2122, Australia ([4]) Uppsala Astronomical Observatory, Sweden

This paper presents abundances for 12 red giants of the old open cluster Collinder 261 based on spectra from VLT/UVES. Abundances were derived for Na, Mg, Si, Ca, Mn, Fe, Ni, Zr and Ba. We find the cluster has a solar-level metallicity of [Fe/H] = -0.03 . However some alpha elements were found to be enhanced. The star-to-star scatter was consistent with the expected measurement uncertainty for all elements. The observed rms scatter is as follows: Na = 0.07, Mg = 0.05, Si = 0.06, Ca = 0.05, Mn = 0.03, Fe = 0.02, Ni = 0.04, Zr = 0.12, and Ba = 0.03 dex. The high levels of homogeneity indicate that chemical information remains preserved in this old open cluster.

We use the chemical homogeneity we have now established in Cr 261, Hyades and the HR1614 moving group to examine the uniqueness of the individual cluster abundance patterns, ie. chemical signatures. We demonstrate that the three studied clusters have unique chemical signatures, and discuss how other such signatures may be searched for in the future. Our findings support the prospect of large scale chemical tagging of disk stars to common formation sites in order to unravel the dissipative history of the Galactic disk.

Accepted by : Astronomical Journal

For preprints, contact `gdesilva@eso.org`

Also available from the URL `http://www.arxiv.org/abs/astro-ph/0611832`
or by anonymous ftp at `ftp://`

. . . . . .

A Young Stellar Cluster Surrounding the Peculiar Eruptive Variable V838 Monocerotis

Afsar, Melike ([2]); Bond, Howard E.

Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218 ([2])Current address: Department of Astronomy and Space Sciences, Ege University, 35100 Bornova, Izmir, Turkey

The unusual variable star V838 Monocerotis underwent an eruption in 2002. It continues to illuminate a spectacular series of light echoes, as the outburst light is scattered from circumstellar dust. V838 Mon has an unresolved B3 V companion star. We serendipitously discovered that a neighboring 16th-mag star is also of type B. We then carried out a survey of other stars in the vicinity, revealing two more B-type stars within 45" of V838 Mon. We have determined the distance to this sparse, young cluster, based on spectral classification and photometric main-sequence fitting of the three B stars. The cluster distance is found to be 6.2+-1.2 kpc, in excellent agreement with the geometric distance to V838 Mon of 5.9 kpc obtained from Hubble Space Telescope polarimetry of the light echoes. Using our distance determination, we show that the B3 V companion of V838 Mon is sufficient to account for the entire luminosity of the star measured on survey photographs before its outburst. The B3 star is currently, however, about 1 mag fainter than before the eruption, suggesting that it is now suffering extinction due to dust ejected from V838 Mon. Considerations of the pre-outburst luminosity and cluster age appear to leave stellar-collision or -merger scenarios as one of the remaining viable explanations for the outburst of V838 Mon.

Accepted by : Astronomical Journal

For preprints, contact `melike.afsar@ege.edu.tr`

Also available from the URL `http://`

or by anonymous ftp at `ftp://`

. . . . . .

5. Galactic Globular Clusters

The Global Kinematics of the Globular Cluster M92

G. A. Drukier ([1]), H. N. Cohn ([2]), P. M. Lugger ([2]), S. D. Slavin ([3]), R. C. Berrington ([4]), B. W. Murphy ([5])

([1]) Yale University ([2]) Indiana University, Bloomington ([3]) Purdue University, Calumet ([4]) University of Wyoming ([5]) Butler University

We report the determination of high-accuracy radial velocities for 299 members of the globular cluster M92 using the Hydra multi-object spectrograph on the WIYN telescope. We have concentrated on stars outside of the central region of the cluster, located up to 14'4 from the cluster center. Candidate members were selected for spectroscopy based on a photometric metallicity index determined from 3-band Washington photometry, also obtained with the WIYN telescope. The median error in the velocities is 0.35 km/s. We find the heliocentric radial velocity of the cluster to be -121.2 +/-0.3 km/s.

We have used an improved Bayesian analysis to determine the velocity dispersion profile of M92. The most probable profile is a cored power-law with a scale radius of 2', velocity dispersion at 1' of 6.3km/s and outer power-law with slope -0.6. We have also reanalyzed the M15 radial velocities of Drukier et al. (1998) and find that a pure power-law with a 1' velocity dispersion of 8 km/s and slope -0.5, and the combination of a power-law with slope -0.4 and scale of 7.5 km/s inside 9' and a dispersion of 4 km/s outside, are equally likely. In both clusters there is evidence that the samples include escaping stars. We present results from a GRAPE-based N-body simulation of an isolated cluster that demonstrates this effect. We suggest additional tests to determine the relative importance of tidal heating and stellar ejection for establishing the velocity field in globular cluster halos.

Accepted by : Astronomical Journal

For preprints, contact drukier@astro.yale.edu

Also available from the URL http://lanl.arxiv.org/abs/astro-ph/0611246
or by anonymous ftp at ftp://

.....

The absolute motion of the peculiar cluster NGC6791

L. R. Bedin ([1]), G. Piotto ([2]), G. Carraro ([2]), I. R. King ([3]), J. Anderson ([4])
(([1])E.S.O.-Garching, (2)Univ.PD, (3)Univ.of Washington, (4)Rice Univ.Houston)

We present improved values of the three components of the absolute space velocity of the open cluster NGC6791. One HST ACS/WFC field with two-epoch observations provides astrometric measurements of objects in a field containing the cluster center. Identification of 60 background galaxies with sharp nuclei allows us to determine an absolute reference point, and measure the absolute proper motion of the cluster. We find $(\mu_\alpha \cos(\delta), \mu_\delta)_{J2000.0}$ = (-0.57+/-0.13, -2.45+/-0.12)mas/yr, and adopt V_{rad} = -47.1+/-0.7km/s from the average of the published values. Assuming a Galactic potential, we calculate the Galactic orbit of the cluster for various assumed distances, and briefly discuss the implications on the nature and the origin of this peculiar cluster.

To appear in : 5 pages, 3 figures, 3 tables. Accepted for publication in A&A Letters, on October 18th 2006
For preprints, contact `lbedin@eso.org`
Also available from the URL `http://`
or by anonymous ftp at `ftp://`

.....

NGC 2298: a globular cluster on its way to disruption

G. De Marchi[1] and L. Pulone[2]

[1]ESA, Space Science Department, Keplerlaan 1, 2200 AG Noordwijk, Netherlands, [2]INAF, Osservatorio Astronomico di Roma, Via di Frascati 33, 00040 Monte Porzio Catone, Italy

We have studied the stellar main sequence (MS) of the globular cluster NGC 2298 using deep HST/ACS observations in the F606W and F814W bands covering an area of $3.4' \times 3.4'$ around the cluster centre or about twice the cluster's half-mass radius. The colour-magnitude diagram that we derive in this way reveals a narrow and well defined MS extending down to the $10\,\sigma$ detection limit at $m_{606} \simeq 26.5$, $m_{814} \simeq 25$, corresponding to stars of $\sim 0.2\,\mathrm{M}_{\odot}$. The luminosity function (LF) obtained with these data, once corrected for the limited effects of photometric incompleteness, reveals a remarkable deficiency of low-mass stars as well as a radial gradient, in that the LF becomes progressively steeper with radius. Using the mass–luminosity relation appropriate for the metallicity of NGC 2298, we derive the cluster's global mass function (GMF) by using a multi-mass Michie–King model. Over the range $0.8 - 0.2\,\mathrm{M}_{\odot}$, the number of stars per unit mass decreases following a power-law distribution of the type $dN/dm \propto m^{0.5}$, where, for comparison, typical halo clusters have $dN/dm \propto m^{-1.5}$. If the IMF of NGC 2298 was similar to that of other metal poor halo clusters, like e.g. NGC 6397, the present GMF that we obtain implies that this object must have lost of order 85 % of its original mass, at a rate much higher than that suggested by current models based on the available cluster orbit. The latter may, therefore, need revision.

Accepted by: Astronomy & Astrophysics
Also available from the URL `http://arxiv.org/abs/astro-ph/0612026`

. . . . . .

Fast rotating massive stars and the origin of the abundance patterns in galactic globular clusters

T. Decressin([1]) G. Meynet([1]) C. Charbonnel([1,2]) N. Prantzos([3]) S. Ekström([1])

([1])Geneva Observatory, University of Geneva, chemin des Maillettes 51, 1290 Sauverny, Switzerland ([2]) Laboratoire d'Astrophysique de Toulouse et Tarbes, CNRS UMR 5572, OMP, 14, Av. E.Belin, 31400 Toulouse, France ([3]) Institut d'Astrophysique de Paris, CNRS UMR 7095, Univ. P. & M.Curie, 98bis Bd. Arago, 75104 Paris, France

We propose the Wind of Fast Rotating Massive Stars scenario to explain the origin of the abundance anomalies observed in globular clusters. We compute and present models of fast rotating stars with initial masses between 20 and 120 Msun for an initial metallicity Z=0.0005 ([Fe/H]=-1.5). We discuss the nucleosynthesis in the H-burning core of these objects and present the chemical composition of their ejecta. We consider the impact of uncertainties in the relevant nuclear reaction rates. Fast rotating stars reach the critical velocity at the beginning of their evolution and remain near the critical limit during the rest of the main sequence and part of the He-burning phase. As a consequence they lose large amounts of material through a mechanical wind which probably leads to the formation of a slow outflowing disk. The material in this slow wind is enriched in H-burning products and presents abundance patterns similar to the chemical anomalies observed in globular cluster stars. In particular, the C, N, O, Na and Li variations are well reproduced by our model. However the rate of the 24Mg(p,gamma) has to be increased by a factor 1000 around 50 MK in order to reproduce the whole amplitude of the observed Mg-Al anticorrelation. We discuss how the long-lived low-mass stars currently observed in globular clusters could have formed out of the slow wind material ejected by massive stars.

Accepted by : Astronomy & Astrophysics

For preprints, contact `Thibaut.Decressin@obs.unige.ch`

Also available from the URL `http://arxiv.org/abs/astro-ph/0611379`

or by anonymous ftp at `ftp://`

. . . . . .

Tracing the development of dust around evolved stars: The case of 47 Tuc

Th. Lebzelter ([1]), Th. Posch ([1]), K.H. Hinkle ([2]), P.R. Wood ([3]), J. Bouwman ([4])
([1]) Department of Astronomy, University of Vienna, Austria ([2]) NOAO, Tucson, USA ([3]) RSAA, Canberra, Australia
([4]) MPIA, Heidelberg, Germany

We observed mid-infrared (7.5–22 μm) spectra of AGB stars in the globular cluster 47 Tuc with the *Spitzer* telescope and find significant dust features of various types. Comparison of the characteristics of the dust spectra with the location of the stars in a logP-K-diagram shows that dust mineralogy and position on the AGB are related. A 13 μm feature is seen in spectra of low luminosity AGB stars. More luminous AGB stars show a broad feature at 11.5 μm. The spectra of the most luminous stars are dominated by the amorphous silicate bending vibration centered at 9.7 μm. For 47 Tuc AGB stars, we conclude that early on the AGB dust consisting primarily of Mg-, Al- and Fe oxides is formed. With further AGB evolution amorphous silicates become the dominant species.

To appear in : astro-ph/0611167
For preprints, contact `lebzelter@astro.univie.ac.at`
Also available from the URL `http://`
or by anonymous ftp at `ftp://`

. . . . . .

A Deep Wide-Field Variable Star Catalog of Omega Centauri

David T F Weldrake ([1]), Penny D Sackett ([2]) & Terry J Bridges ([3]).
[1]: MPIA, Konigstuhl 17, Heidelberg 69117 Germany.
[2]: RSAA, Mount Stromlo Observatory, Cotter Road, Weston Creek, ACT 2611 Australia.
[3]: Physics Department, Queens University, Kingston, Ontario, K7L 3N6, Canada.

We present a variable star catalog of an extensive ground-based wide-field variability survey in the globular cluster omega Centauri. Using the ANU 40-inch (1m) telescope at Siding Spring Observatory, the cluster was observed with a 52'x52' (0.75 deg^2) field for 25 nights. A total of 187 variable stars were identified in the field, 81 of which are new discoveries. This work comprises the widest field variability survey yet undertaken for this cluster. Here we present the V+R lightcurves and preliminary analysis of the detected variable stars, comprising 58 eclipsing binaries, 69 RR Lyrae stars, 36 long period variables (P>=2d) and 24 miscellaneous pulsators including 15 SX Phoenicis stars and two Type II Cepheids. Analysis of the eclipsing binary radial distribution has revealed an apparent lack of binaries in the 8'-15' range, perhaps indicating two separate binary populations. Four detached binaries have short periods (<2.5d) and are likely composed of low-mass M-dwarf components, useful for testing stellar evolution models. One further detached system has a period of 0.8 days and due to the blueness of the system could be composed of white dwarf stars. Analysis of the RR Lyrae sample has produced a reddening corrected distance modulus (also accounting for metallicity spread) for the cluster of 13.68+-0.27, a result consistent with previously published values. This paper also presents a total stellar database comprising V and I photometry (with astrometry better than 0.25") for 203,892 stars with 12.0<V<21.0 and 25-night V+R lightcurves for 109,726 stars (14.0<V<22.0) for both the cluster and the field.

Accepted by : Astronomical Journal
For preprints, contact `weldrake@mpia-hd.mpg.de`
Also available from the URL `http://www.mpia.de/homes/weldrake/index.html`
or by anonymous ftp at `ftp://`

.....

6. Extragalactic Clusters

Colour-colour diagrams and extragalactic globular cluster ages. Systematic uncertainties using the (V-K)-(V-I) diagram

Maurizio Salaris Santi Cassisi
Liverpool John Moores University (UK)
INAF- Osservatorio Astronomico Collurania (Italy)

We investigate biases in cluster ages and [Fe/H] estimated from the (V-K)-(V-I) diagram, arising from inconsistent Horizontal Branch morphology, metal mixture, treatment of core convection between observed clusters and the theoretical colour grid employed for age and metallicity determinations. We also study the role played by statistical fluctuations of the observed colours, caused by the low total mass of typical globulars. Horizontal Branch morphology is potentially the largest source of uncertainty. A single-age system harbouring a large fraction of clusters with an HB morphology systematically bluer than the one accounted for in the theoretical colour grid, can simulate a bimodal population with an age difference as large as 8 Gyr. When only the redder clusters are considered, this uncertainty is almost negligible, unless there is an extreme mass loss along the Red Giant Branch phase. The metal mixture affects mainly the redder clusters; the effect of colour fluctuations becomes negligible for the redder clusters, or when the integrated Mv is brighter than -8.5 mag. The treatment of core convection is relevant for ages below $\sim$4 Gyr. The retrieved [Fe/H] distributions are overall only mildly affected; colour fluctuations and convective core extension have the largest effect. When 1sigma photometric errors reach 0.10 mag, all biases found in our analysis are erased, and bimodal age populations with age differences of up to $\sim$8 Gyr go undetected. The use of both (U-I)-(V-K) and (V-I)-(V-K) diagrams may help disclosing the presence of blue HB stars unaccounted for in the theoretical colour calibration.

Accepted by : Astronomy & Astrophysics
For preprints, contact `ms@astro.livjm.ac.uk`
Also available from the URL `http://`
or by anonymous ftp at `ftp://`

. . . . . .

A Survey of Compact Star Clusters in the South-West Field of the M31 Disk. UBVRI Photometry

D. Narbutis[1], V. Vansevičius[1], K. Kodaira[2], I. Šablevičiūtė[1], R. Stonkutė[1,3] and A. Bridžius[1]

[1]Institute of Physics, Savanorių 231, Vilnius LT-02300, Lithuania
[2]The Graduate University for Advanced Studies (SOKENDAI), Shonan Village, Hayama, Kanagawa 240-0193, Japan
[3]Vilnius University Observatory, Čiurlionio 29, Vilnius LT-03100, Lithuania

We present the results of UBVRI broad-band aperture CCD photometry of 51 compact star clusters located in the South-West part of the M31 disk. The mean rms errors of all measured star cluster colors are less than 0.02 mag. In color vs. color diagrams the star clusters show significantly tighter sequences when compared with the photometric data from the compiled catalog of the M31 star clusters published by Galleti et al. (2004).

Accepted by: Baltic Astronomy 15, 461 (2006)
For preprints, contact donatas.narbutis@ff.vu.lt
Also available from the URL http://arxiv.org/abs/astro-ph/0610161

. . . . . .

Physical parameters of 15 intermediate-age LMC clusters from modelling of HST colour-magnitude diagrams

L.O. Kerber ([1]), B.X. Santiago ([2]), and E. Brocato ([3])

([1]) IAG/USP, Sao Paulo, Brazil; (2) IF/UFRGS, Porto Alegre, Brazil; ([3]) INAF - Osservatorio Astronomico di Collurania, Teramo, Italy

We analyzed HST/WFPC2 colour-magnitude diagrams (CMDs) of 15 populous Large Magellanic Cloud (LMC) stellar clusters with ages between $\sim$ 0.3 Gyr and $\sim$ 3 Gyr. These (V, B-V) CMDs are photometrically homogeneous and typically reach V $\sim$ 22. Accurate and self-consistent physical parameters (age, metallicity, distance modulus and reddening) were extracted for each cluster by comparing the observed CMDs with synthetic ones. These determinations involved simultaneous statistical comparisons of the main-sequence fiducial line and the red clump position, offering objective and robust criteria to determine the best models. The models explored a regular grid in the parameter space covered by previous results found in the literature. Control experiments were used to test our approach and to quantify formal uncertainties. In general, the best models show a satisfactory fit to the data, constraining well the physical parameters of each cluster. The age-metallicity relation derived by us presents a lower spread than similar results found in the literature for the same clusters. Our results are in accordance with the published ages for the oldest clusters, but reveal a possible underestimation of ages by previous authors for the youngest clusters. Our metallicity results in general agree with the ones based on spectroscopy of giant stars and with recent works involving CMD analyses. The derived distance moduli implied by the most reliable solutions, correlate with the reddening values, as expected from the non-negligible three-dimensional distribution of the clusters within the LMC. The inferred spatial distribution for these clusters is roughly aligned with the LMC disk, being also more scattered than recent numerical predictions, indicating that they were not formed in the LMC disk. The set of ages and metallicities homogeneously derived here can be used to calibrate integrated light studies applied to distant galaxies.

Accepted by : Astronomy & Astrophysics

For preprints, contact `kerber@astro.iag.usp.br`

Also available from the URL `http://arxiv.org/abs/astro-ph/0610722`

or by anonymous ftp at `ftp://`

. . . . . .

The Peculiar Main Sequence of the Double Star Cluster NGC 2011 in the Large Magellanic Cloud with Hubble Space Telescope WFPC2 Observations

D. A. Gouliermis ([1]), S. Lianou ([2]), M. Kontizas ([2]), E. Kontizas ([3]), A. Dapergolas ([3])

([1]) Max-Planck-Institut fuer Astronomie, Heidelberg, Germany ([2]) University of Athens, Dpt of Astrophysics, Astronomy and Mechanics, Greece ([3]) National Observatory of Athens, Institute of Astronomy and Astrophysics, Greece

We report the serendipitous discovery of a peculiar main sequence in archived Hubble Space Telescope WFPC2 observations of the young star cluster NGC 2011 in the Large Magellanic Cloud. The bright part of this main sequence exhibits a prominent double, fork-like feature, as if it consists of twin main sequences, one of them being redder. The color-magnitude diagram, constructed from the stars found in the only available WFPC2 field of the cluster, is used to distinguish the stars according to their membership to each of these sequences and to study their spatial distribution. We find that there are two well distinguished populations in the sense that the redder main sequence is dominated by stars that belong to the main body of the cluster, while the stars of the bluer main sequence belong to the surrounding region. Providing that NGC 2011 is a verified binary cluster, with the second companion unfortunately not observed, and taking into account the general region where this cluster is located, we discuss the possible scenarios from both star formation, and early dynamical evolution point-of-view that might explain this unique discovery.

Accepted by : Astrophysical Journal

For preprints, contact `dgoulier@mpia.de`

Also available from the URL `http://lanl.arxiv.org/abs/astro-ph/0610653`

or by anonymous ftp at `ftp://`

.....

7. Dynamical simulations - Theory

The core radius of a star cluster containing a massive black hole

Douglas C. Heggie ([1]), Piet Hut ([2]), Shin Mineshige ([3]), Jun Makino ([4]), Holger Baumgardt ([5])

([1]) University of Edinburgh, UK ([2]) Princeton University, USA ([3]) University of Kyoto, Japan ([4]) National Observatory of Japan ([5]) Bonn University, Germany

We present a theoretical framework which establishes how the core radius of a star cluster varies with the mass of an assumed central black hole. Our result is that the ratio of core to half-mass radius varies as the 3/4 power of the ratio of the black hole to cluster mass. The theory compares favourably with a number of simulations of this problem, which extend to black hole masses of order 10% of the cluster mass. Though strictly limited as yet to clusters with stars of equal mass, our conclusion strengthens the view that clusters with large core radii are the most promising candidates in which to find a massive black hole.

Submitted to : Publication of the ASJ
For preprints, contact `d.c.heggie@ed.ac.uk`
Also available from the URL `http://arxiv.org/abs/astro-ph/0611950`
or by anonymous ftp at `ftp://`

.....

2D Fokker-Planck models of rotating clusters

Fiestas, J. ([1,2]), Spurzem, R. ([1,2]), Kim, E. ([3])
([1]) Zentrum fuer Astronomie Heidelberg ([2]) Rhein Stellar-Dynamical Network ([3]) Harvard-Smithsonian Center for Astrophysics

Globular clusters rotate significantly, and with the increasing amount of detailed morphological and kinematical data obtained in recent years on galactic globular clusters many interesting features show up. We show how our theoretical evolutionary models of rotating clusters can be used to obtain fits, which at least properly model the overall rotation and its implied kinematics in full 2D detail (dispersions, rotation velocities). Our simplified equal mass axisymmetric rotating model provides detailed two-dimensional kinematical and morphological datafor star clusters. The degree of rotation is not dominant in energy, but also non-negligible for the phase space distribution function, shape and kinematics of clusters. Therefore the models are well applicable for galactic globular clusters. Since previously published papers onthat matter by us made it difficult to do detailed comparisons with observations we provide a much more comprehensive and easy-to-use set of data here, which uses as entries dynamical age and flattening of observed cluster and then offers a limited range of applicable models in full detail. The method, data structure and some exemplary comparison with observations are presented. Future work will improve modelling and data base to take a central black hole, a mass spectrum and stellar evolution into account.

Accepted by : Monthly Notices of the Royal Astronomical Society
For preprints, contact `fiestas@ari.uni-heidelberg.de`
Also available from the URL `http://arxiv.org/pdf/astro-ph/0609056`
or by anonymous ftp at `ftp://`

.....

Performance Analysis of Direct N-Body Algorithms on Special-Purpose Supercomputers

Stefan Harfst, Alessia Gualandris, David Merritt, Rainer Spurzem, Simon Portegies Zwart, Peter Berczik

Department of Physics and Astronomy, Rochester Institute of Technology, Rochester, NY 14623
Astronomical Institute Anton Pannekoek and Section Computational Science, University of Amsterdam, The Netherlands
Astronomisches Rechen-Institut, Zentrum für Astronomie, Universität Heidelberg, Heidelberg, Germany
Main Astronomical Observatory, National Academy of Science, Kiev, Ukraine, 03680

Direct-summation N-body algorithms compute the gravitational interaction between stars in an exact way and have a computational complexity of $\mathcal{O}(N^2)$. Performance can be greatly enhanced via the use of special-purpose accelerator boards like the GRAPE-6A. However the memory of the GRAPE boards is limited. Here, we present a performance analysis of direct N-body codes on two parallel supercomputers that incorporate special-purpose boards, allowing as many as four million particles to be integrated. Both computers employ high-speed, Infiniband interconnects to minimize communication overhead, which can otherwise become significant due to the small number of "active" particles at each time step. We find that the computation time scales well with processor number; for 2×10^6 particles, efficiencies greater than 60% and speeds in excess of ~ 3 TFlops are reached.

Submitted to : New Astronomy
For preprints, contact `harfst@astro.rit.edu`
Also available from the URL `http://www.grapecluster.rit.edu`
or by anonymous ftp at `ftp://`

. . . . . .

Captured older stars as the reason for apparently prolonged star formation in young star clusters

Pflamm-Altenburg, J. ([1,2]) Kroupa, P. ([1,2])

([1]) Argelander Institute for Astronomy (AIfA) ([2]) The Rhine Stellar Dynamical Network (RSDN)

The existence of older stars within a young star cluster can be interpreted to imply that star formation occurs on time scales longer than a free-fall time of a pre-cluster cloud core. Here the idea is explored that these older stars are not related to the star formation process forming the young star cluster but rather that the orbits of older field stars are focused by the collapsing pre-cluster cloud core. Two effects appear: The focussing of stellar orbits leads to an enhancement of the density of field stars in the vicinity of the centre of the young star cluster. And due to the time-dependent potential of the forming cluster some of these stars can get bound gravitationally to the cluster. These stars exhibit similar kinematical properties as the newly formed stars and can not be distinguished from them on the basis of radial-velocity or proper-motion surveys. Such contaminations may lead to a wrong apparent star-formation history of a young cluster. In the case of the ONC the theoretical number of gravitationally bound older low-mass field stars agrees with the number of observed older low-mass stars.

Accepted by : Monthly Notices of the Royal Astronomical Society
For preprints, contact `jpflamm@astro.uni-bonn.de , pavel@astro.uni-bonn.de`
Also available from the URL `http://arxiv.org/abs/astro-ph/0611517`
or by anonymous ftp at `ftp://`

.....

Cluster-assisted accretion for massive stars

S. Pfalzner
I. Physikalisches Institut University Cologne Germany

Gravitational interactions in very young high-density stellar clusters can to some degree change the angular momentum in the circumstellar discs surrounding initially the majority of stars. However, for most stars the cluster environment alters the angular momentum only slightly. For example, in simulations of the Orion Nebula cluster (ONC) encounters reduce the angular momentum of the discs on average at most by 3-5% and in the higher density region of the Trapezium by 15-20% - still a minor loss process. However, in this paper it is demonstrated that the situation is very different if one considers high-mass stars (M*>10 M(solar) only. Assuming an age of 2 Myr for the ONC, their discs have on average a 50-90% lower angular momentum than primordially. This enormous loss in angular momentum in the disc should result in an equivalent increase in accretion, implying that the cluster environment boosts accretion for high-mass stars, thus making them even more massive.

To appear in : ApJL
For preprints, contact `pfalzner@ph1.uni-koeln.de`
Also available from the URL `http://`
or by anonymous ftp at `ftp://`

. . . . . .

Tidal tails around globular clusters. Are they a good tracer of cluster orbits?

M. Montuori([1]), R. Capuzzo-Dolcetta ([2]), P. Di Matteo ([3]), A.Lepinette ([4]), P.Miocchi ([5])

([1]) CNR, Roma, Italy ([2]) Dep. of Physics, Univ. La Sapienza, Roma, Italy ([3]) Obs. de Paris, Paris, France ([4]) CSIC/INTA, Torrejon de Ardoz, Spain ([5]) INAF, Osservatorio di Teramo, Teramo, Italy

We present the results of detailed N-body simulations of clusters moving in a realistic Milky Way potential. The strong interaction with the bulge and the disk of the Galaxy leads to the formation of tidal tails, emanating from opposite sides of the cluster. Some characteristic features in the morphology and orientation of these streams are recognized and intepreted. The tails have a complex morphology, in particular when the cluster approaches its apogalacticon, showing multiple "arms" in remarkable similarity to the structures observed around NGC 288 and Willman 1. Actually, the tails are generally good tracers of the cluster path quite far from the cluster center (>7-8 tidal radii), while on the smaller scale they are mainly pointing in the direction of the Galaxy center. In particular, the orientation of the inner part of the tails is highly correlated to the cluster orbital phase and to the local orbital angular acceleration. This implies that, in general, the orbital path cannot be estimated directly from the orientation of the tails, unless a sufficient large field around the cluster is available.

Submitted to : Astrophysical Journal

For preprints, contact `montuorm@roma1.infn.it`

Also available from the URL `http://babbage.sissa.it/abs/astro-ph/0611204`

or by anonymous ftp at `ftp://`

.....

8. Miscellaneous

New Galactic Wolf-Rayet stars, and candidates. An annex to The VIIth Catalogue of Galactic Wolf-Rayet Stars

Karel A. van der Hucht
SRON National Institute for Space Research, Utrecht, Netherlands

This paper gathers, from the literature and private communication, 72 new Galactic Population I Wolf-Rayet stars and 17 candidate WCLd stars, recognized and/or discovered after the publication of The VIIth Catalogue of Galactic Wolf-Rayet Stars. This brings the total number of known Galactic Wolf-Rayet stars to 298, of which 24 (8%) are in open cluster Westerlund 1, and 60 (20%)are in open clusters near the Galactic Center. (published: A&A 458, 453 (2006)

Accepted by : Astronomy & Astrophysics
For preprints, contact `k.a.van.der.hucht@sron.nl`
Also available from the URL `http://www.sron.nl`
or by anonymous ftp at `ftp://`

. . . . . .

Massive Star and Star Cluster Formation

Jonathan C. Tan
Dept. of Astronomy, University of Florida

I review the status of massive star formation theories: accretion from collapsing, massive, turbulent cores; competitive accretion; and stellar collisions. I conclude the observational and theoretical evidence favors the first of these models. I then discuss: the initial conditions of star cluster formation as traced by infrared dark clouds; the cluster formation timescale; and comparison of the initial cluster mass function in different galactic environments.

To appear in the proceedings of IAU Symposium 237, "Triggered Star Formation in a Turbulent ISM", eds. B. G. Elmegreen & J. Palous
For preprints, contact `jt @ astro.ufl.edu`
Also available from the URL `http://www.astro.ufl.edu/~jt/`
or by anonymous ftp at `ftp://`

. . . . . .

The Initial Mass Function in Clusters

Bruce G. Elmegreen
IBM Watson Research Center

The stellar initial mass function (IMF) in star clusters is reviewed. Uncertainties in the observations are emphasized. We suggest there is a distinct possibility that cluster IMFs vary systematically with density or pressure. Dense clusters could have additional formation processes for massive stars that are not present in low density regions, making the slope of the upper mass IMF somewhat shallower in clusters. Observations of shallow IMFs in some super star clusters and in elliptical galaxies are reviewed. We also review mass segregation and the likelihood that peculiar IMFs, as in the Arches cluster, result from segregation and stripping, rather than an intrinsically different IMF. The theory of the IMF is reviewed in some detail. Several problems introduced by the lack of a magnetic field in SPH simulations are discussed. The universality of the IMF in simulations suggests that something more fundamental than the physical details of a particular model is at work. Hierarchical fragmentation by any of a variety of processes may be the dominant cause of the power law slope. Physical differences from region to region may make a slight difference in the slope and also appear in the low-mass turnover point.

To appear in : astroph/0610687
For preprints, contact `bge@watson.ibm.com`
Also available from the URL `http://`
or by anonymous ftp at `ftp://`

. . . . . .

Formation and Evolution of Young Massive Clusters

Bruce G. Elmegreen
IBM Watson Research Center

Clusters are the dense inner regions of a wide-spread hierarchy of young stellar structures. They often reveal a continuation of this hierarchy inside of them, to smaller scales, when they are young, but orbital mixing eventually erases these subparts and a only smooth cluster or smooth unbound group remains. The stellar hierarchy follows a similar structure in the interstellar gas, which is presumably scale-free because of supersonic motions in the presence of turbulence and self-gravity. The efficiency of star formation increases automatically with density in a hierarchical ISM, causing most dense stellar groups to be initially bound for local conditions. In lower pressure environments, the infant mortality rates should be higher. Also following from hierarchical structure is the cluster mass distribution function and perhaps also the cluster size distribution function, although the predicted mass-size relation is not observed. Cluster destruction is from a variety of causes. The destruction time should depend on cluster mass, but the various groups who have studied this dependence have gotten significantly different results so far.

To appear in : astroph/0610679
For preprints, contact `bge@watson.ibm.com`
Also available from the URL `http://`
or by anonymous ftp at `ftp://`

. . . . . .

Hierarchical Formation of Galactic Clusters

Bruce G. Elmegreen
IBM Watson Research Center

Young stellar groupings and clusters have hierarchical patterns ranging from flocculent spiral arms and star complexes on the largest scale to OB associations, OB subgroups, small loose groups, clusters and cluster subclumps on the smallest scales. There is no obvious transition in morphology at the cluster boundary, suggesting that clusters are only the inner parts of the hierarchy where stars have had enough time to mix. The power-law cluster mass function follows from this hierarchical structure: $n(M) \sim M^{-b}$ for $b \sim 2$. This value of b is independently required by the observation that the summed IMFs from many clusters in a galaxy equals approximately the IMF of each cluster.

To appear in : astroph/0605519
For preprints, contact `bge@watson.ibm.com`
Also available from the URL `http://`
or by anonymous ftp at `ftp://`

.....

SK 1: A Possible Case of Triggered Star Formation in Perseus

Rengel, M.; Hodapp, K.-W.; Eislöffel, J.

AA(Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany), AB(Institute for Astronomy, Hilo, United States), AC(Thüringer Landessternwarte Tautenburg, Tautenburg, Germany)

According to a triggered star formation scenario (e.g. Martin-Pintado & Cernicharo 1987) outflows powered by young stellar objects shape the molecular clouds, can dip cavities, and trigger new star formation. NGC 1333 is an active site of low- and intermediate star formation in Perseus and it is a suggested site of self-regulated star formation (Normal & Silk 1980). Therefore it is a suitable target for a study of triggered star formation, and for further observations of discovered triggered star formation candidates (e.g. Sandell & Knee 2001, SK01). For another hand, continuum submillimetre observations of star forming regions can detect dust thermal emission of embedded sources (which drive outflows), and further detailed structure. Within the framework of our wide-field mapping of star formation regions in the Perseus and Orion molecular clouds using SCUBA at 850 and 450 & 956, we map NCG 1333 with an area of around 14' x 21'. The maps show more structure than the previously been observed in submillimetre for the region. We have unveiled the known embedded SK 1 source (in the dust shell south of the SSV 13 ridge) and detailed structure, among some other young stellar sources. In agreement with the SK01 observations, our map of the region shows lumpy filaments and shells/cavities that seem to be created by outflows. The measured mass of SK 1 (∼0.07 M[o]) is much less than its virial mass (∼0.2-1 M[o]). Our observations support the idea of SK 1 as an event triggered by outflow-driven shells in NGC 1333 (induced by an increase in gas pressure and density due to radiation pressure from the stellar winds, that have presumably created the dust shell). This kind of evidences provides a more thorough understanding of the star formation regulation processes.

To appear in : Triggered Star Formation in a Turbulent ISM, International Astronomical Union. Symposium no. 237, held 14-18 August, 2006 in Prague, Czech Republic, S237, 38

For preprints, contact `rengel@mps.mpg.de`

Also available from the URL `http://`

or by anonymous ftp at `ftp://`

. . . . . .

The metallicity of circumnuclear star forming regions

A.I. Diaz, E. Terlevich, M. Castellanos, G. Hageles

Universidad Autonoma de Madrid,Spain INAOE, Puebla, Mexico Instituto de Estructura de la Materia, CSIC, Madrid, Spain Universidad Autonma de Madrid, Spain

We present a spectrophotometric study of circumnuclear star forming regions (CNSFR) in the early type spiral galaxies: NGC 2903, NGC 3351 and NGC 3504, all of them of over solar metallicity according to standard empirical calibrations. A detailed determination of their abundances is made after careful subtraction of the very prominent underlying stellar absorption. It is found that most regions show the highest abundances in HII region-like objects. The relative N/O and S/O abundances are discussed.It is also shown that CNSFR, as a class, segregate from the disk HII region family, clustering around smaller "softness parameter" – ή- values, and therefore higher ionizing temperatures.

To appear in : The Metal Rich Universe, La Palma, June 2006

For preprints, contact `angeles.diaz@uam.es`

Also available from the URL `http://`

or by anonymous ftp at `ftp://`

. . . . . .

Triggered Star Formation in OB Associations

Chen, W. P., Lee, Hsu-Tai Lee, & Sanchawala, Kaushar
Graduate Institute of Astronomy, National Central University, Taiwan

We present causal and positional evidence of triggered star formation in bright-rimmed clouds in OB associations, e.g., Ori OB1, and Lac OB1, by photoionization. The triggering process is seen also on a much larger scale in the Orion-Monoceros Complex by the Orion-Eridanus Superbubble. We also show how the positioning of young stellar groups surrounding the H II region associated with Trumpler 16 in Carina Nebula supports the triggering process of star formation by the collect-and-collapse scenario.

To appear in : IAU Symposium 237
For preprints, contact `wchen@astro.ncu.edu.tw`
Also available from the URL `http://www.astro.ncu.edu.tw`
or by anonymous ftp at `ftp://`

. . . . . .

A New Parallel N-body Code

Harfst et al. (2006, New Astronomy, submitted, astro-ph/0608125, see also p. 25 of this Newsletter) have recently presented a "Performance Analysis of Direct N-Body Algorithms on Special-Purpose Supercomputers" using phiGRAPE, a direct N-body code optimized for running on a parallel GRAPE-6A cluster. This code is now publicly available at

http://wiki.cs.rit.edu/bin/view/GRAPEcluster/phiGRAPE

. . . . . .

First Announcement

12 Questions on Star and Massive Star Cluster Formation

An new-format ESO workshop held in Garching, July 3-6, 2007

organized by: Tom Wilson and Markus Kissler-Patig

THIS IS THE CALL FOR "THE QUESTIONS":
Become a SAC member! Propose a question!
How? See below. Deadline is December 15th, 2006.
Registration will start January 2007.

More infos at: www.eso.org/star07

Objective:

The goal is to bring together two communitites: the one working on star formation (mostly galactic) and the one working on the formation of young massive clusters (mostly extra-galactic). We will link galactic with extra-galactic work, optical/NIR techniques with sub-mm/ mm/radio ones, the formation of stars with the one of massive star clusters - observations and theory. Views will be exchanged on topics such as the earliest phases of star and star cluster formation, ultra- compact and ultra-dense HII regions, embedded massive star and star clusters, stages at which stars and clusters emerge in the NIR and the optical, ending with young massive clusters observed in starburst.

The Format:

The format is bold and new, aiming to focus attention on the critical 12 questions in this area. Each question will be addressed by all speakers in a dedicated 1.5h session including a 20 min introduction and many 10-15 min contributions to finish in a 30 min general discussion (with accompanying posters).

The Questions:

We call until December 15th, 2006 for proposals of questions around which the program will be built. The final program will then be announced in January 2007. YOU can propose one (1) question - if your question is selected for the final program, you become a Science Advisory Committee (SAC) member and you commit a) to give the 20 min introduction to that question at the conference and b) to coordinate the chapter reserved to that question in the proceedings. The question should be 1) of interest to both communities: star formation and star cluster formation (at least one speaker of "the other" community must sign up for the question); 2) focussed enough that it can be interestingly debated in 1.5h (e.g. "How do stars form?" does not qualify).

Pre-register:

Interested in getting further emails about this event? Send us a brief email: star07@eso.org with the Subject line: - "Keep me posted", if you want to get the final program in January - "Here is

a question", if you want to submit a question (by December 15th, 2006). In which case you should send us the exact wording of your question together with a (200 words) abstract explaining why this question is currently important and of interest to both communities.

The Choice of Questions:
Tom Wilson and Markus Kissler-Patig will prepare the final set of 12 questions by January, present the final program and call for contributions to the 12 sessions. In case of identical or very similar questions, we might seek council of wise women/men to assign it to one of the proposers (or simply flip a coin if we run out of good arguments).

We hope for your numerous contributions and to see you in July in Garching,

Tom Wilson & Markus Kissler-Patig

. . . . . .

First Announcement

Joint European and National Astronomy Meeting 2007
"Our non-stable Universe"
20-25 August, 2007
Yerevan, Armenia

JENAM is the Joint European and National Astronomy Meeting organized each year in one of the European countries jointly by the European Astronomical Society and one of the national astronomical societies. JENAM-2007 will take place in Yerevan (Armenia) and will be the 15th Annual Meeting of the European Astronomical Society (EAS) and the 6th Annual Meeting of the Armenian Astronomical Society (ArAS). JENAM consists of a number of EAS Symposia and Special Sessions on various aspects of modern astronomy (see Topics).

The JENAM will consist of 6 Plenary sessions (invited reviews on hot topics of modern astrophysics), 8 EAS Symposia, and 7 Special Sessions (SPS). The EAS Symposia will last 2-3 days each, 4 Symposia in parallel. The SPS will last 1 or 2 days each, 3 SPS in parallel. Poster sessions will be organized as well for each of the Symposia and SPS. Highlight talks for young astronomers will be organized, too. The tentative program already is available.

EAS Symposium 6 will discuss the dynamics of galaxies and galactic nuclei. The focus will be on the theoretical and dynamical modeling, and on the interface between modeling and observations. Therefore contributions to new observational results are particularly welcome as well.

Topics to be covered in EAS Symposium 6 include:

- Formation and Evolution of Galactic and Extragalactic Star Clusters
- Gravitational Waves from Dense Star Clusters and Black Holes in Galaxies
- Numerical Modeling and Computing of galaxies and star clusters
- Interaction between new astrophysical data Management and theory/modeling

For more information about the conference programme and important deadlines, please have a look at the following websites:

http://www.aras.am/JENAM-2007/ (Jenam 2007 main site)
http://www.aras.am/JENAM-2007/EASsymp06.htm (EAS Symposium 6)
http://www.ari.uni-heidelberg.de/jenam2007/EASsymp06.htm (EAS Symposium 6)

or contact the organiser of EAS Symposium 6, Rainer Spurzem (spurzem@ari.uni-heidelberg.de).

. . . . . .

Second Announcement

The Milky Way Halo - Stars and Gas
Locations, Motions, Origins
Bonn (Germany), 29 May - 2 June 2007

Dear Colleagues,

this is the second announcement for the Milky Way Halo conference to be held at the Argelander Institute for Astronomy (AIfA) of Bonn University from the 29th of May to the 2nd of June, 2007. The study of the Milky Way Halo and its constituents has seen numerous developments in recent years. The 2007 conference aims at bringing together knowledgeable researchers to discuss the current state of understanding of the halo.

Scope:

Topics to be addressed are:
- recent surveys of stars and gas in the halo
- studies of the distributions and the space motions of stars and gas
- studies of the space motions of Milky Way star clusters and dwarf galaxies
- models of the kinematics, as well as the origins of the stars, the gas, and the dwarf galaxies.

Venue:

The AIfA is located at Auf dem Hügel 71, 53121 Bonn, Germany. The meeting will use the lecture room of the AIfA. Attendence is therefore somewhat limited.

Registration:

Please register formally for the conference and provide the information as asked (including Title and Abstract of your contribution). Please arrange by 1 May 2007 for the payment of the registration fee (which includes the conference dinner on Thursday 31 May) to the account indicated in the registration document. The registration document will be mailed back to you, for your records.

Contact:

For definite informations please refer to the conference webpage at:

http://www.astro.uni-bonn.de/∼mwhalo.

If you need further information, please send an email to mwhalo@astro.uni-bonn.de

. . . . . .

FIRST ANNOUNCEMENT

Dynamical Evolution of Dense Stellar Systems
IAU Symposium 246
5-9 September 2007, Capri, Italy

Scientific Rationale:

Dense stellar systems are an interface between dynamics, stellar evolution, formation of galaxies and provide us with an ideal laboratory to understand many different aspects of these important fields as well as to explore the interplay between them. A wealth of observational data have now provided firm observational evidence showing that the dynamical evolution of a cluster, its structural and kinematical properties, the properties of its stellar population, the abundance of exotic objects such as pulsars, X-rays sources, blue stragglers are closely related to each other: a full understanding of the evolution of star clusters can not be reached without properly considering the interplay between stellar dynamics and stellar evolution. An equally large amount of observational data from studies focusing on star cluster systems in the Galaxy and in external galaxies have allowed us to explore the dependence of a number of properties of globular cluster systems on the type and the properties of the host galaxy. These studies have convincingly shown that the role played by the host galaxy in the formation and evolution of star clusters is an important additional element along with the effects of stellar dynamics, stellar evolution and their complex interplay.

The complete study of the formation and evolution of star clusters is a very challenging task which requires the collaboration and the exchange of ideas of astronomers and physicists with observational and theoretical expertise in Galactic and extra-galactic astronomy, stellar dynamics, hydrodynamics and stellar evolution. Expertise on the development of special-purpose hardware and software and, more in general, on many aspects of computational physics also plays a key role in this endeavor.

This symposium will cover all the aspects of the study of star clusters with particular emphasis on the interplay between them and on the comparison between observations and simulations.

Scientific Topics:

1) Stellar cluster formation and early evolution
2) Young clusters in external galaxies, in starburst galaxies and mergers
3) Few-body stellar systems
4) Open and Globular Clusters: Observations, simulations and comparison between observations and simulations
5) Interplay between binary dynamics and evolution and stellar cluster dynamical evolution
6) Exotic stellar populations
7) Galactic and extra-galactic globular cluster systems
8) Computational aspects of simulations of dense stellar systems

Organization:

SOC: S.Aarseth, H.Baumgardt, C.Boily, M.Giersz, D.Heggie, P.Hut, V.Kalogera, J.Makino, R.Mardling, S.McMillan, G.Meylan, S.Mikkola, S.Portegies Zwart, F.Rasio, A.Sills, R.Spurzem, M.Trenti, E.Vesperini(Chair)

LOC: E.Ferraro, A.Pecoraro(co-Chair), M.Trenti(co-Chair)

Scientific Program:

There will be a number of invited talks (see the conference website for the list of invited speakers), contributed talks and posters. See the conference website (http://www.physics.drexel.edu/∼iaus246) for information on abstract submission.
$\Longrightarrow$ **Abstract submission deadline to be considered for an oral presentation: April 20, 2007**

Location:

The symposium will be held in the Conference Center of the island of Capri (Italy). Capri is a small beautiful island about 120 miles south of Rome.

Celebration:

The Symposium will be in honor of Douglas C. Heggie and it will be the occasion to celebrate his 60th birthday.

Registration:

The conference will be open to about 200 participants.
Registration is already open.
Please visit the conference website at

http://www.physics.drexel.edu/∼iaus246

for information about registration and to download the registration fee payment form.

Financial support:

We have IAU funds to support part of the travel, lodging and registration costs of some participants. Please see the symposium website for additional information on how to apply for IAU financial support (please notice that the application form has to be sent to the SOC Chair).

$\Longrightarrow$ **DEADLINE TO APPLY FOR IAU FINANCIAL SUPPORT: March 1, 2007**

Additional Information:

See the symposium website http://www.physics.drexel.edu/ iaus246
or send an e-mail to: iaus246@physics.drexel.edu
Enrico Vesperini -On behalf of the SOC

Postdoctoral Fellowship in Theoretical and Computational Astrophysics at the Rochester Institute of Technology

The astrophysics group at the Rochester Institute of Technology is seeking an outstanding postdoctoral researcher in theoretical astrophysics. We are particularly interested in candidates with computational experience, to make use of the superb facilities at RIT for gravitational dynamics simulations. These include a 32-node GRAPE cluster with a speed of 4 Tflops; a GRAPE-6; and a 110-node general-purpose supercomputer. Among the topics of current research interest at RIT are evolution of galactic nuclei, calculation of event rates for gravitational wave detectors, and interaction of supermassive black holes with their stellar and gaseous environments. Outstanding candidates in related fields will also be considered. The initial appointment will be for 2 years and may be renewable for a third year. To apply, please send a CV and statement of research interests and arrange for two or three letters of recommendation to be sent to David Merritt at merritt@astro.rit.edu. Applications will continue to be considered until an offer is made.

http://astrophysics.rit.edu/

For more information on this position, please contact David Merritt at (585) 465-7973 or via merritt@astro.rit.edu .

David MERRITT
Department of Physics
85 Lomb Memorial Drive
Rochester Institute of Technology
Rochester, NY 14623-5604
Phone: 585-475-7973
Web: http://astrophysics.rit.edu/
E-mail: merritt@astro.rit.edu

Tenure-Track Research Faculty Positions at the Rochester Institute of Technology

In support of its new Ph.D. program in Computing and Information Sciences, Rochester Institute of Technology's B. Thomas Golisano College of Computing and Information Sciences is seeking outstanding individuals to fill three tenure-track research faculty positions. The program focuses on the theoretical and practical aspects of cyberinfrastructure as applied to specific problems across multiple domains. We are building strengths in: astroinformatics, bioinformatics, computational biology, computational science, environmental informatics, medical informatics, services sciences, and electronic commerce. The requirements of each position include an earned doctorate in a relevant discipline, a strong record of research in the application of computing technology to problems in the sciences, mathematics, engineering, business, or social sciences, and a proven record of acquiring research funding. Preference will be given to candidates with experience in developing cyberinfrastructure (including but not limited to: high performance computing, grid computing, data mining, visualization, human-computer interaction, or modeling and simulation). All candidates should be able to contribute to RIT's commitment to cultural diversity and pluralism. The faculty responsibilities will include teaching and research. Tenure, rank, and salary are negotiable. The target start date for these positions is September 1, 2007. Review of applications will begin January 15, 2007 and will continue until all positions are filled. Candidates should visit http://www.rit.edu/ gccis for more information about the college. Electronic submission of application materials to gccisfacultyrecruitment@rit.edu is encouraged. Applications must include a summary of education and professional background, a list of publications and research grants, a summary of teaching and research experience, the names and contact information of at least three references, and a brief statement describing his or her research agenda.

Rochester Institute of Technology
20 Lomb Memorial Drive,
Rochester, NY 14623-5604
Tel. 585-475-7203
Fax 585-475-4775
http://www.gccis.rit.edu