TOSCA - Topical Overview on Star Cluster Astrophysics

Report of Contributions

Contribution ID: **2**   Type: **not specified**

Constraining the Diffusion Coefficient and Cosmic-Ray Acceleration Efficiency using Gamma-ray Emission from the Star-Forming Region RCW 38

Tuesday 29 October 2024 14:55 (5 minutes)

We report a detailed study of gamma-ray emission near the young Milky Way star cluster (0.5 Myr old) in the star-forming region RCW 38. Using 15 years of data from the Fermi-LAT, we find a significant ($\sigma > 22$) detection coincident with the cluster, producing a total gamma-ray luminosity of L = (2.66±0.92) x 10^34 erg s^-1 adopting a power-law spectral model ($\Gamma = 2.34\pm0.04$) in the 0.1-500 GeV band. Using an empirical relationship and Starburst99, we estimate the total wind power to be 7×10^{36} erg s^{-1}. This corresponds to a CR acceleration efficiency of $\eta_{CR} = 0.4$ for a diffusion coefficient consistent with the local interstellar medium of D = 10^28 cm^2 s^−1. Alternatively, the gamma-ray luminosity could also account for a lower acceleration efficiency of 0.1 if the diffusion coefficient in the star-forming region is smaller D = 2.5 x 10^27 cm^2 s^−1. In addition, we perform a Chandra X-ray analysis of the region to compare the hot-gas pressure from the CR pressure and find the former is four orders of magnitude greater, suggesting that the CR pressure is not dynamically important relative to the stellar wind feedback. As RCW 38 is too young for supernovae to have occurred, the high CR acceleration efficiency in RCW 38 demonstrates that stellar winds may be an important source of Galactic cosmic rays.

Primary author: PANDEY, Paarmita (The Ohio State University)

Co-authors: Prof. ROSEN, Anna (San Diego State University); Prof. LOPEZ, Laura (The Ohio State University); Prof. LINDEN, Tim (Stockholm University); Prof. THOMPSON, Todd (The Ohio State University)

Presenter: PANDEY, Paarmita (The Ohio State University)

Session Classification: Contributed posters - Flash Talks

Contribution ID: **3**   Type: **not specified**

Gamma-ray signatures of particle acceleration at stellar wind termination shocks up to PeV energies

Tuesday 29 October 2024 14:45 (5 minutes)

Young massive stellar clusters have recently brought attention as PeVatrons candidates, to explain the knee of the cosmic ray spectrum and how protons can be accelerated to such energy scale in galactic sources. The new detector LHAASO is the first to probe well the photon detection band >0.1 PeV, that can correspond to multi-PeV hadronic cosmic rays. Thus, it enables the use of its gamma-ray data to constrain the galactic particle acceleration models and parameters, and to identify the contribution from the different categories of galactic accelerators to the observed cosmic ray flux, especially in the PeV domain.

To that extent, we model the escape and the transport of cosmic rays from their accelerator to molecular clouds, where a lot of p-p interactions producing gamma rays occur. We are focusing on the case where the source is a young massive star cluster, hence the particles are accelerated in stellar wind termination shocks before escaping. We try to determine in a semi-analytical approach the parameters needed (distance between cloud and source, time, slope of injection, number of stars, etc) to produce an excess in the gamma-ray flux corresponding to PeV cosmic rays, that could be detectable by LHAASO. This enables to constrain the subspace of the parameter space for which a detectable excess could exist, and therefore constrains the subset of systems (cluster+cloud) that could produce such an excess. Then, the goal is to find such systems and compare predictions of the models for the gamma-ray flux to LHAASO data in order to determine more precisely different acceleration parameters, such as the wind termination shock efficiency or the injection spectrum in the interstellar medium. Another goal is to try to explain some of the dark PeVatrons seen by LHAASO with systems star cluster+cloud.

Primary author: INVENTAR, Alexandre (APC Laboratory)

Co-author: Dr GABICI, Stefano (APC Laboratory)

Presenter: INVENTAR, Alexandre (APC Laboratory)

Session Classification: Contributed posters - Flash Talks

Contribution ID: **4**

Type: **not specified**

A census of OB stars within 1 kpc and the star formation and core collapse supernova rates of the Milky Way

Thursday 31 October 2024 10:40 (30 minutes)

O- and B-type stars constitute valuable tools across many areas of astronomy. They are significant sources of stellar feedback, through which they enrich the interstellar medium in new chemical elements, but also contribute to and hinder the emergence of future generations of stars. Being short-lived, they tend to remain near their birth environment, and thereby are vital tracers of the position and motion of the Milky Way spiral arms. Furthermore, they are crucial to study star formation and early evolution, as well as stellar multiplicity.

It is thus important to map out the distribution of OB stars across the Galaxy. Data from Gaia DR3 offers an opportunity to produce an updated census of their population. In this work, we have applied an improved, flexible SED fitting tool to identify and characterize OB stars in the solar neighborhood. With this tool we have identified about 25,000 O- and B-type stars (hotter than 10,000 K) within 1 kpc of the Sun, with a completeness of 90-95 % across all magnitudes. This list of OB stars typically include fainter stars non-included in similar catalogues, and reach higher completeness particularly in the solar neighborhood (< 300 pc).

Several overdensities on this map correspond to well-known regions such as Orion, Sco-Cen, Vela OB2, Cepheus and Circinus, hinting at the presence of OB associations and/or massive star clusters. These overdensities thereby constitute potential sources of stellar feedback, driving particle acceleration in the surrounding medium, and also future targets for detection of gravitational waves. Since we used our census of OB stars to provide a new estimation of the star formation and supernova rates within the local Milky Way, we have confirmed this by determining a rate of about 20 core-collapse supernova explosions per million year within 1 kpc.

Primary author: QUINTANA, Alexis (University of Alicante)

Co-authors: MARTINEZ GARCIA, Juan (Keele University); WRIGHT, Nick

Presenter: QUINTANA, Alexis (University of Alicante)

Session Classification: Population properties

Contribution ID: **5**   Type: **not specified**

Protostellar Jets as Particle Accelerators. The case of HH 80-81.

Tuesday 29 October 2024 15:05 (5 minutes)

Massive stars are capable to accelerate particles due to their powerful winds ejected during the main sequence and post-main sequence evolutionary stages. However, recent studies on massive young stellar objects with *Fermi*-LAT have demonstrated that collimated jets, created by the protostars while they are still accreting mass, can produce a significant amount of accelerated particles even though during the pre-main sequence stages.

In this context, we have studied the particle acceleration in IRAS 18162-2048, a massive protostar with ~20 $M_\odot$ that powers the longest collimated jet in our galaxy. The jet is located in a very dense environment, surrounded by a recently reported protostellar cluster with many medium and low-mass protostars. The main knots of the jet (HH 80, HH 81, and HH 80N) have been detected in radio and X-ray wavelengths, emitting non-thermal emission. In this work, we have associated a *Fermi*-LAT 4FGL source with the protostellar jet based on positional arguments.

The study of the high-energy spectrum of the source, spanning from 300 MeV to ~1 GeV, suggests a soft particle distribution consistent with diffusive shock acceleration. We test both leptonic and hadronic models, finding them consistent with the kinetic energy of the outflow jet. We also perform a morphological analysis, finding interesting correlations between the emission and the molecular clouds in the region.

In our poster, we will present the detection of gamma-ray emission originated by a protostar in a star-forming region. The proven capability of massive stellar objects for accelerating particles since their forming stages is an interesting starting point for analyzing cosmic ray production within massive star-forming clusters, as we expect many of these protostars in the densest regions of the active forming clusters.

Primary author: MÉNDEZ-GALLEGO, Javier (IAA-CSIC)

Co-authors: Dr DE OÑA WILHELMI, Emma (DESY); Dr OTERO-SANTOS, Jorge (IAA-CSIC); Dr FEDRIANI, Rubén (IAA); Dr LÓPEZ-COTO, Rubén (IAA-CSIC)

Presenter: MÉNDEZ-GALLEGO, Javier (IAA-CSIC)

Session Classification: Contributed posters - Flash Talks

Contribution ID: **6**   Type: **not specified**

Isolated massive star candidates in nearby star forming galaxies

Tuesday 29 October 2024 14:40 (5 minutes)

The debate on whether star formation of massive stars always occurs clustered or could also happen in isolation is still open. Although small in numbers, massive stars strongly affect the environment around them: they can stop or trigger star formation, reshape the distribution of the gas around them and enrich the ISM due to supernova events or stellar winds. Thus, understanding how frequently high-mass stars can form in isolation in sparse density environments becomes extremely important. So far this has mostly been studied in only three Local Group galaxies: the Milky Way and the Magellanic Clouds. All three galaxies show a fraction of seemingly isolated massive stars that do not appear to be part of even very low-mass clusters nor can be explained as runaways or walkaways.

In order to shed light onto this open question, we are undertaking a systematic survey of other star-forming galaxies in the Local Volume to address this question with better statistics, using high-resolution photometry from two UV-optical Hubble Space Telescope legacy surveys, GULP and LEGUS. In this poster presentation, I will mainly focus on the spiral galaxy NGC 4242 and compare our findings to the Local Group.

Primary author: FACCHINI, Pietro (Zentrum für Astronomie der Universität Heidelberg, Astronomisches Rechen-Institut)

Co-authors: Dr PASQUALI, Anna (Zentrum für Astronomie der Universität Heidelberg, Astronomisches Rechen-Institut); Prof. GREBEL, Eva (Zentrum für Astronomie der Universität Heidelberg, Astronomisches Rechen-Institut)

Presenter: FACCHINI, Pietro (Zentrum für Astronomie der Universität Heidelberg, Astronomisches Rechen-Institut)

Session Classification: Contributed posters - Flash Talks

Contribution ID: **8**   Type: **not specified**

Creating a Hydrodynamic simulation of Cygnus OB2

Tuesday 29 October 2024 15:00 (5 minutes)

The Cygnus X star-forming region has been of great interest to the high-energy astrophysics community due to the diffuse gamma-ray emission detected by Fermi, HAWC and LHASSO in recent years. At the heart of this region lies the OB association Cygnus OB2, with tens of powerful O stars and 3 Wolf-Rayet stars. It has been argued that efficient stellar wind interactions in the vicinity of massive star clusters create favourable conditions for particle acceleration up to very high energies, which could potentially explain the observed diffuse gamma-ray emission in this region. However the core of Cygnus OB2 is rather extended, which puts into question the appropriateness of simplified spherical models and calls for a more detailed investigation of the wind-wind interaction given the peculiarity of the region.

In this poster, we describe a large-scale hydrodynamic simulation of a massive star cluster whose stellar population mimics that of the Cygnus OB2 association, as a collaborative project between research groups specialising in both particle acceleration theory and winds of massive stars. The main-sequence stars are first simulated during 1.6 Myr, until a quasi-stationary state is reached. At this time, the three Wolf-Rayet stars observed in Cygnus OB2 are added to the simulation, which continues to 2 Myr. Using a high-resolution grid in the centre of the domain, we can resolve the most massive stars individually, which allows us to probe the kinetic structures at small (parsec) scales. We find that, although the cluster excavates a spherical "superbubble"cavity, the stellar population is too loosely distributed to blow a large-scale cluster wind termination shock, and that collective effects from wind-wind interactions are much less efficient than usually assumed. This challenges our understanding of the ultra-high energy emission observed from the region. This work includes detailed treatment of the massive stellar population, incorporating Gaia astrometric data, empirically determined mass loss and terminal wind velocities for the most powerful stars, and stellar evolution. In this poster we will emphasise how these considerations directly affect results of interest to the high-energy astrophysics community.

Primary author: LARKIN, Cormac (MPI Kernphysik/ARI)

Co-authors: SANDER, Andreas; REVILLE, Brian; HÄRER, Lucia; VIEU, Thibault (Max-Planck-Institut für Kernphysik); RAMACHANDRAN, Varsha

Presenter: LARKIN, Cormac (MPI Kernphysik/ARI)

Session Classification: Contributed posters - Flash Talks

Contribution ID: **9**   Type: **not specified**

Review on Galactic cosmic rays

Tuesday 29 October 2024 09:00 (40 minutes)

I will try to provide a brief and critical review of the standard paradigm for the origin of Galactic cosmic rays. Recent measurements of local and far-away cosmic rays reveal unexpected behaviours, which challenge the commonly accepted scenario. These recent findings will be discussed, together with long-standing open issues. Despite the progress made thanks to ever-improving observational techniques and theoretical investigations, at present our understanding of the origin and of the behaviour of cosmic rays remains incomplete. It is still unclear whether a modification of the standard paradigm, or rather a radical change of the paradigm itself is needed in order to interpret all the available data on cosmic rays within a self-consistent scenario.

Presenter: GABICI, Stefano

Session Classification: Particle acceleration and propagation

Contribution ID: **10**   Type: **not specified**

Review Gamma Rays

Monday 28 October 2024 14:35 (40 minutes)

Presenter: Dr TIBALDO, Luigi (IRAP)

Session Classification: Gamma-ray observations

Contribution ID: **11**

Type: **not specified**

Overview of the Cygnus OB2 region in gamma-rays

Monday 28 October 2024 16:35 (30 minutes)

Presenter: YANG, ruizhi

Session Classification: Gamma-ray observations

Contribution ID: **12**   Type: **not specified**

Recent results on Stellar clusters as detected by HESS

Monday 28 October 2024 15:15 (30 minutes)

Presenter: MOHRMANN, Lars

Session Classification: Gamma-ray observations

Contribution ID: **13**   Type: **not specified**

Young massive clusters with Fermi-LAT

Monday 28 October 2024 15:45 (30 minutes)

Presenter: PERON, Giada (Istituto Nazionale di Astrofisica (INAF))

Session Classification: Gamma-ray observations

Contribution ID: **14**
Type: **not specified**

Population studies of SCs derived from Fermi-LAT observations

Monday 28 October 2024 17:05 (30 minutes)

Presenter: WEBBER, Ava (Clemson University)

Session Classification: Gamma-ray observations

Contribution ID: **15**   Type: **not specified**

Prospect for gamma-ray detection of Galactic stellar clusters

Monday 28 October 2024 17:35 (30 minutes)

Presenter: MITCHELL, Alison (Erlangen Centre for Astroparticle Physics, Friedrich-Alexander-Universität Erlangen-Nürnberg)

Session Classification: Gamma-ray observations

Contribution ID: **16** · · · Type: **not specified**

Multimessanger astrophysics from SCs

Tuesday 29 October 2024 12:40 (30 minutes)

Presenter: CELLI, Silvia (Sapienza University of Rome & INFN)

Session Classification: Particle acceleration and propagation

Contribution ID: **17**   Type: **not specified**

Stellar wind interaction around young star clusters: 3D MHD simulations

Tuesday 29 October 2024 09:40 (30 minutes)

The environments of young star clusters are shaped by the interaction of the powerful winds of massive stars and their feedback on the cluster birth cloud. Several such regions show diffuse TeV gamma-ray emission on the degree scale, which hints at ongoing particle acceleration. To date, particle acceleration and transport in star cluster environments are not well understood. A characterisation of magnetic fields and flow structures is essential to progress toward physical models. Due to the large extent of these regions on the sky and their low densities, magnetic field and flow are difficult to constrain from observations. Previous work employing simulations has mostly focused on stellar wind feedback on the surrounding medium, often modelling the energy injection from the star cluster as point-like. I will discuss our recent work on modelling the interaction of individual stellar winds in a young cluster with 3D ideal MHD, which underlines the complex, dynamic nature of young star cluster environments.

Presenter: HÄRER, Lucia

Session Classification: Particle acceleration and propagation

Contribution ID: **18**   Type: **not specified**

Deciphering the Cygnus region

Tuesday 29 October 2024 10:10 (30 minutes)

The Cygnus region has become a gamma-ray source of prime interest since the detection of ultra-high energy photons by LHAASO. This likely indicates the presence of a hadronic source of PeV cosmic rays in the region, although the accelerator has not been yet identified. In this talk, I will summarize our knowledge of this star-forming complex and, using large-scale hydrodynamic simulations, I will critically assess possible acceleration mechanisms, in particular related to the Cygnus OB2 association. I will show that wind-wind interactions are not efficient enough to enhance particle acceleration, and that a cluster wind termination shock is not expected to form. Therefore, it seems that the gamma-ray spectrum can only be understood by considering recent supernovae explosions in the region.

Presenter: VIEU, Thibault (Max-Planck-Institut für Kernphysik)

Session Classification: Particle acceleration and propagation

Contribution ID: **19**   Type: **not specified**

Gamma-rays from star clusters and their implication for Galactic cosmic rays

Tuesday 29 October 2024 10:40 (30 minutes)

I will discuss acceleration and transport of nuclei in star clusters and their escape from the bubble, with particular focus on the modification of the spectra of nuclei accelerated at the termination shock. The recently detected gamma ray emission from the Cygnus region allows us to infer some general conclusions concerning the role of star clusters as contributors to the flux of Galactic cosmic rays.

Presenter: Prof. BLASI, Pasquale

Session Classification: Particle acceleration and propagation

Contribution ID: **20**   Type: **not specified**

Superbubbles as Galactic PeVatrons: The Potential Role of Rapid Second-Order Fermi Acceleration

Tuesday 29 October 2024 11:40 (30 minutes)

Superbubbles are now one of the few remaining potential PeVatron candidates in the Galaxy, based on the identification of the Cygnus Cocoon as a LHAASO identified PeVatron and Westerlund 1 as a very powerful TeV gamma-ray source with a large shell-like morphology. At the moment, it is not clear how superbubbles accelerate particles to PeV energies. Recent focus has been on the role of the collective cluster wind termination shock which could accelerate particles through first order Fermi acceleration. However, it is not clear whether the termination shock is powerful enough or even always existent. A termination shock may explain the shell-like morphology of Westerlund 1, but then requires a leptonic origin of the gamma-ray emission.

In this talk I will argue that second-order Fermi acceleration in the tenuous region outside the termination may be fast enough to accelerate particles to the PeV domain. What is required is a large Alfvén velocity (V>500 km/s), caused by the tenuous density, and a high level of magnetic-field turbulence. For the latter cosmic-ray containment estimates based on gamma-ray observations provide evidence.

Presenter: VINK, Jacco

Session Classification: Particle acceleration and propagation

Contribution ID: **21**   Type: **not specified**

Cosmic rays from Galactic star clusters

Tuesday 29 October 2024 12:10 (30 minutes)

In this contribution, I will discuss about a model for the production of cosmic rays from massive, young star clusters present in the Galaxy. I will show that cosmic-ray acceleration at the shocks associated with fast stellar winds of star clusters can produce significant contribution in cosmic rays at energies ~ 10^16 - 10^18 eV. When combined with the contribution from regular supernova remnants in the Galaxy and an extra-galactic component, cosmic-rays from star clusters can reasonably explain the observed all-particle spectrum and composition of cosmic rays.

Presenter: THOUDAM, Satyendra

Session Classification: Particle acceleration and propagation

Contribution ID: **22** Type: **not specified**

Aluminium-26 from massive star clusters: theory and observations

Monday 28 October 2024 18:05 (30 minutes)

Presenter: DIEHL, Roland

Session Classification: Gamma-ray observations

Contribution ID: **23**   Type: **not specified**

Young massive star clusters as Galactic PeVatrons

Tuesday 29 October 2024 14:50 (5 minutes)

Presenter: BONOLLO, Alberto (Istituto Nazionale di Astrofisica (INAF))

Session Classification: Contributed posters - Flash Talks

Contribution ID: **24**   Type: **not specified**

Review Stellar Feedback

Tuesday 29 October 2024 15:10 (40 minutes)

Presenter: ROSEN, Anna (San Diego State University)

Session Classification: Stellar feedback

Contribution ID: **25** Type: **not specified**

Stellar wind bubbles

Tuesday 29 October 2024 15:50 (30 minutes)

Presenter: LANCHASTER, Lachlan

Session Classification: Stellar feedback

Contribution ID: **26**   Type: **not specified**

Simulations of stellar feedback

Tuesday 29 October 2024 16:20 (30 minutes)

Presenter: ALI, Ahmad

Session Classification: Stellar feedback

Contribution ID: **27**

Type: **not specified**

Cosmic-ray feedback

Tuesday 29 October 2024 18:10 (30 minutes)

Presenter: GIRICHIDIS, Philipp

Session Classification: Stellar feedback

Contribution ID: **28**   Type: **not specified**

Cosmic ray-driven astrochemistry

Tuesday 29 October 2024 18:40 (30 minutes)

Presenter: GACHES, Brandt

Session Classification: Stellar feedback

Contribution ID: **29**

Type: **not specified**

Dynamic of HII regions

Tuesday 29 October 2024 17:40 (30 minutes)

Presenter: MATZNER, Christopher (University of Toronto)

Session Classification: Stellar feedback

Contribution ID: **30**
Type: **not specified**

Observations of HII regions

Tuesday 29 October 2024 17:10 (30 minutes)

Presenter: ANDERSON, Loren

Session Classification: Stellar feedback

Contribution ID: **31**   Type: **not specified**

Review Stellar Wind Physics -1

Wednesday 30 October 2024 09:00 (35 minutes)

Presenter: SUNDQVIST, Jon

Session Classification: Stellar wind physics

Contribution ID: **32**   Type: **not specified**

Review: Wolf-Rayet winds

Wednesday 30 October 2024 09:35 (35 minutes)

Presenter: SANDER, Andreas

Session Classification: Stellar wind physics

Contribution ID: **33**   Type: **not specified**

Winds from very massive stars

Wednesday 30 October 2024 10:10 (30 minutes)

Presenter: SABHAHIT, Gautham

Session Classification: Stellar wind physics

Contribution ID: **34**   Type: **not specified**

Colliding Winds and non-Thermal emission

Wednesday 30 October 2024 10:40 (30 minutes)

Presenter: PITTARD, Julian

Session Classification: Stellar wind physics

Contribution ID: **35** · Type: **not specified**

Stellar wind simulations and bow shocks

Wednesday 30 October 2024 11:40 (30 minutes)

Presenter: MACKEY, Jonathan

Session Classification: Stellar wind physics

Contribution ID: **36**   Type: **not specified**

X-rays from the Winds of Massive Stars

Wednesday 30 October 2024 12:10 (30 minutes)

Presenter: OWOCKI, Stan

Session Classification: Stellar wind physics

Contribution ID: **37**   Type: **not specified**

Stellar Physics and the Chemical Enrichment of the ISM from Massive Stars

Wednesday 30 October 2024 12:40 (30 minutes)

Presenter: LIMONGI, Marco (Istituto Nazionale di Astrofisica (INAF))

Session Classification: Stellar wind physics

Contribution ID: **38** Type: **not specified**

Review Population properties

Thursday 31 October 2024 09:00 (40 minutes)

Presenter: SABBI, Elena

Session Classification: Population properties

Contribution ID: **39**   Type: **not specified**

Why are some massive stars found in clusters and some in OB associations?

Thursday 31 October 2024 09:40 (30 minutes)

Presenter: APELLÁNIZ, Jesús Maíz

Session Classification: Population properties

Contribution ID: **40**   Type: **not specified**

Massive stars in OB associations

Thursday 31 October 2024 10:10 (30 minutes)

Presenter: BERLANAS, Sara

Session Classification: Population properties

Contribution ID: **41**
Type: **not specified**

Massive stars ejected from clusters

Thursday 31 October 2024 11:40 (30 minutes)

Presenter: OEY, Sally

Session Classification: Population properties

Contribution ID: **42**   Type: **not specified**

X-ray observations of massive star clusters

Thursday 31 October 2024 12:10 (30 minutes)

Presenter: GUARCELLO, Mario Giuseppe (Istituto Nazionale di Astrofisica (INAF))

Session Classification: Population properties

Contribution ID: 43   Type: **not specified**

The life cycle of star clusters in low-metallicity dwarf galaxies

Thursday 31 October 2024 12:40 (30 minutes)

The earliest known proto-globular clusters (GCs) detected with the James Webb Space Telescope were compact (effective radii ~parsecs) and extremely dense, ideal to harbour energetic massive stars and possibly intermediate mass black holes. The detailed conditions and time-scales of star formation and stellar feedback during the earliest stages of galaxy assembly are however still unclear. This is both due to the limiting resolution (parsecs) and sensitivity in even the most optimal gravitationally lensed detections; and the lack of complementary high-fidelity simulations able to capture the key astrophysical processes of clustered star formation on small, sub-parsec scales.

In the GRIFFIN project (Galaxy Realizations Including Feedback From INdividual massive stars) we examine the formation and evolution of resolved star clusters up to the GC-mass range using high-resolution (sub-parsec, star-by-star) hydrodynamical simulations. Our low-metallicity dwarf galaxy simulations account for the radiation, stellar winds and supernovae of individual stars. I will briefly discuss how massive star clusters form hierarchically and rapidly over time-scales of less than 10 Myr, yet they are able to self-enrich through stellar winds. Recently, we supplemented the methodology with a regularised integrator to accurately solve the stellar gravitational dynamics on small spatial scales. This was shown to be critically important for the modelling of more realistic star cluster life cycles from formation until disruption in the tidal field of the host galaxy. I will conclude with future avenues toward unravelling the cosmic origin of GCs.

Presenter: LAHEN, Natalia

Session Classification: Population properties