Gaia-RIA workshop coordinated by the Red Española de Explotación Científica de Gaia
Institut de Ciències del Cosmos (ICCUB), Barcelona, February, 17-19th 2020

List of abstracts

Public Surveys and new instrumentation for Calar Alto Observatory
J. Aceituno (CAHA)

The Calar Alto observatory (CAHA) is a key institution for the international astronomical community, for its highly competitive astronomical facilities (telescopes and instrumentation). From 2019 on, the current administration of CAHA includes the Junta de Andalucía as a new partner – replacing the Max Planck Gesellschaft -, and together with the Spanish National Research Council (CSIC) these two institutions manage the operation of the observatory.

The recent success of long-term observational projects already finished (CALIFA) or close to finalization (CARMENES), or the contribution to GAIA through spectroscopic surveys together with the innovative tradition in available instrumentation of CAHA, point to the necessity of a new call to the international astronomical community for scientific and technological proposals that will contribute to keep the level of excellence of the observatory. The talk will summarize the action guidelines for new legacy programs and instrumental cases for the 2.2 and 3.5m telescopes."

Galactic Archeology with Gaia and APOGEE
Friedrich Anders (ICCUB)

The SDSS/APOGEE survey has collected almost 500,000 high-resolution near-infrared spectra of Gaia stars spread over tens of kpc along the Galactic disc, bulge, and halo, reaching even to the far side of the bulge.I will review the key Galactic Archaeology results obtained from APOGEE data, with a focus on the combined Gaia+APOGEE dataset that has proven crucial for resolving some key questions regarding Galactic structure and evolution (e.g. the origin of stellar overdensities in the outer Galaxy, the diverse signatures of inside-out galaxy formation, or the quantification of stellar migration in the disc).

Searching nearby exoplanets for direct imaging
Guillem Anglada-Escudé (ICE-IEEC)

Nearby stars are the best targets for exoplanetary studies. Nearby exoplanetary systems have the dual advantage of being in brighter stellar hosts (more signal) and displaying a larger angular separation between the planet and the host star, which also translates into a larger astrometric

signal. Despite the radial velocity technique has been the most successful one in detecting nearby planets, astrometry should in principle reveal many more objects on a broader variety of targets. In particular, the estimates based on Gaia precision anticipate the discovery of between a few thousand to a few tens of thousands of nearby planets (mostly Gas giant in few years orbits). Once the presence of a planet has been established with astrometry or any other technique, the task of detecting them in direct light becomes less daunting and might be feasible with near future instruments installed on ground based giant telescopes.

CHRONOS: towards a homogeneous age scale

David Barrado, H. Bouy, N. Huélamo, M. Morales-Calderón, E. Solano, S. Barceló, J. Lillo-Box , L. Sarro, A. Berihuete, N. Miret, J. Olivares, A.Bayo (CAB(INTA-CSIC)+)

Age is one of the most fundamental parameters of any astrophysical object. It is key to truly understand a large plethora of phenomena, from stars and planets to galaxies. However, different age-dating techniques produce values with discrepancies up to 50%. The main culprit for this state of affairs is the lack of a universal age scale and the absence of a systematic and robust cross-calibration of the various methods. Our goal is to deliver a universal, self-consistent, absolute and accurate method to estimate the age of stars and stellar associations over the entire time domain. This will be achieved by applying modern Bayesian statistical tools to new and archive data in a selected sample of stellar associations. The role of Gaia is crucial in this complex endeavour.

Synergies between Gaia data, ground observations, and Machine learning algorithms

Héctor Cánovas (ESAC)

The vast dataset provided by the Gaia mission combined with the wealth of multi-wavelength observations nowadays available open new exciting avenues for research in astronomy. In this talk I will present a case example showing how ALMA observations, Gaia data, and machine learning (density-based clustering algorithms), can be combined to increase our knowledge about the members of the rho-Ophiuchus star forming region and their surrounding protoplanetary discs. I will finish discussing potential ways to facilitate access to the tools needed to perform this type of research to the astronomy community.

Gaia mean spectra: representation and calibration

Josep Manel Carrasco, C. Jordi, M. Weiler, C. Fabricius (ICCUB-IEEC)

The third Gaia data release will be the first including mean spectra obtained with the low-resolution blue (BP) and red (RP) Gaia spectrophotometers. In the previous release, the data from these instruments was only published as integrated fluxes and not as spectra itself. We describe the characteristics of the BP and RP instruments and the ingredients to be taken into account when calibrating this data. The dispersion of these instruments depends on the wavelength considered and the position in the focal plane. This variation of the dispersion is added to the fact that the PSF produce some blurring of the spectra, adding complexity to the calibration process. The instrument model to refer all observations to a common (mean) instrument is explained. Once the variations of the instrument in every transit is known we can finally combine all observations of the same source to build its mean spectra. This mean spectra is represented as a combination of basis functions and the contribution of these functions for every source is defined when fitting its source coefficients. It is planned that the catalogue contain these coefficients plus the basis functions considered will be

the values describing the source. Some tool will also be provided to transform these coefficients to its sampled spectra.Title: Gaia mean spectra: representation and calibration

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Machine learning and Gaia DR2, on the hunt for open clusters
Alfred Castro-Ginard, C. Jordi and X. Luri (ICCUB-IEEC)

With the unprecedented wealth of Gaia DR2 data, containing precise all-sky astrometry and photometry up to G=21, the view of the open cluster population has dramatically changed. Machine learning techniques to detect so far unknown open clusters have revealed that our samples were not complete, arising the need to build an open cluster sample as complete and reliable as possible to enable further studies in the Galactic disc. This contribution presents a machine learning based methodology able to detect statistical overdensities in the Gaia DR2 astrometric space using DBSCAN algorithm, and identify them as open clusters if their member stars follow an isochrone pattern in the color-magnitude diagram via an artificial neural network. This methodology, fully adapted to a Big Data environment, has led to the discovery of more than 650 open clusters in the Galactic disc.

Science with 4MOST
Cristina Chiappini (AIP, Germany)

This talk presents the status on the project and summary of the surveys.

The Gaia-LSST synergy: resolved stellar populations in selected Local Group stellar systems
Gisella Clementini (INAF, Italy)

This talk will deal with the Gaia LSST synergy: from Pulsating Stars to Star Formation history.

GUASOM flavour DR3
C. Dafonte, Marco A. Álvarez, D. Garabato, R. Santoveña, M. Manteiga (Univ. La Coruña)

La próxima release de Gaia incluirá por primera vez espectrofotometría obtenida con los instrumentos BP y RP. Esta información, junto con la astrometría y fotometría que obtiene el satélite, se utiliza para proporcionar al usuario la clasificación de las fuentes observadas. Para aquellas fuentes que no pueden ser clasificadas con suficiente confianza, los outliers de clasificación, se va a proporcionar una segmentación no supervisada basada en mapas SOM. Para visualizar los resultados de este agrupamiento se publicará una herramienta, GUASOM flavour DR3, que se describirá en esta comunicación.

A high spectroscopic resolution study of massive supergiant stars in Per OB1
de Burgos, Abel; Simón-Díaz, Sergio; Patrick, Lee (IAC+)

Studying the OB associations in our galaxy is very important for many studies in astronomy. These are regions where stars with masses above 5 $M_\odot$ at different evolutionary stages can be found. Hence, they are perfect laboratories to study massive star evolution.
We have studied the PerOB1 association through its population of massive supergiant stars. We analyzed a sample of 70 blue and red supergiants, combining high-resolution multi-epoch data,

obtained with FIES/NOT and HERMES/Mercator, with Gaia DR2 data of proper motions and parallaxes, to investigate their membership and kinematics.
In this talk I will present the main results of this study, including the identification of potential runaways/walkaways from the cluster, as well as spectroscopic binary systems.

Gaia and Solar System data
René Duffard (IAA)

In Gaia DR2 release, there are astrometric and photometric data for a large number of asteroids. I will present the multiple uses of the Solar System data quoting several examples used currently. I will present the use of astrometric stellar data to predict stellar occultations by minor bodies. Several successful positive stellar occultations with high impact publications will be presented. The photometric data on asteroids, on the other hand, are a different case and can be used in different cases that will be presented here. Modelling the light curve of an asteroid, to obtain the final 3D shape is a successful result obtained. Obtaining the photometric properties of the observed asteroids are another example. Finally, I will present different examples where the Gaia DR2 can be used.

Gaia: Past, Present and Future
Claus Fabricius & Gaia UB Team (ICCUB-IEEC)

We emphasize the massive effort and the long period - more than 25 years - from the original GAIA proposal to the widely used Gaia-DR2, which is yielding a similar number of refereed papers per year as HST. We also summarise the contents of the coming EDR3 and DR3 release, where especially proper motions will improve by at least a factor two. We finally look at the promises of future space astrometry missions like the GaiaNIR proposal.

EMIR & MIRADAS in the Gaia era: status and prospects
Francisco Garzón (IAC)

This talk deals with the description of the capabilities, status and short and medium term plans of the two NIR MOS instruments of the GTC, EMIR and MIRADAS.

Extremely iron-poor stars and the Early Galaxy in the context of Gaia
Jonay I. González Hernández, David S. Aguado, Carlos Allende-Prieto (IAC)

Low-mass iron-poor stars formed in the very Early Universe, merely a few hundred million years after the Big Bang. Some of these stars are still alive in the Galactic halo. They keep locked key information on the early metal-enrichment of the Universe, the properties of the first stars, and the first supernovae.
In the last few years, our group has discovered four low-mass stars with extremely-low iron content, at [Fe/H] < -4.5, and among the 14 known stars with the lowest metallicities. These stars provide new insight on the primordial nucleosynthesis and the very early enrichment of the Galaxy.
However, the numbers are still too small to draw solid conclusions about the Early formation of the Galaxy. Combining Gaia, WEAVE, J-PAS and GTC will significantly increase these numbers in the near future, unveiling the chemical signatures of the first stars. I will discuss the prospects for this exciting project in the context of Gaia and other photometric and spectroscopic surveys.

Characterization of binary central stars of planetary nebulae detected by GALEX
Gómez-Muñoz, Marco A.; Manchado, A.; Bianchi, L.

Several models have been proposed to explain the morphologies observed in planetary nebulae (PNe) but central star (CS) binarity is now thought to be critical for understanding the formation and evolution of bipolar PNe, which are a large fraction of PNe. Most of the methods to detect binary CSPN are based on optical or IR surveys, or in optical spectra long-term monitoring, looking for cool components. However, hot-WD in binaries in particular offer invaluable clues to stellar evolution. We have analyzed the extended PNe found in GALEX catalog matched to optical surveys. We have isolated the CSPNe flux from the PN nebular emission and constructed the UV-optical spectral energy distribution (SED). We characterized the stellar parameters of the CSPNe by fitting the SED using non-LTE atmosphere models, for hot and cool stars, with an MCMC method using Gaia DR2 distances.

Propiedades de las estrellas centrales de nebulosas planetarias con distancias en Gaia DR2
Iker González-Santamaría, M. Manteiga, A. Manchado, A. Ulla y C. Dafonte (Univ. La Coruña)

Hemos creado un catálogo de estrellas centrales de nebulosas planetarias (NPs) con posiciones y distancias fiables obtenidas a partir de la astrometría de Gaia DR2. Las distancias estimadas mediante el método Bayesiano de Bayler-Jones (2018) nos han permitido analizar la distribución galáctica de las NPs y estimar otros parámetros, como tamaños, edades cinemáticas, magnitudes bolométricas o luminosidades.

The Nearest Massive Star Forming Region with Gaia and WEAVE: an exploration of Cygnus X
Artemio Herrero, S.R. Berlanas, S. Simon-Diaz, D.J. Lennon, N. Wright, J. Drew and the WEAVE-SCIP team

In this contribution we first present the result obtained by our group combining Gaia DR2 data with the analysis of spectroscopic observations of massive OB stars. We unveil for the first time the spatial substructures in Cyg OB2, explore its possible abundance gradients as a consequence of former SNe explosions and reveal its recent history of star formation.
Then we present the extension of this work to a larger area in Cygnus, using the Gaia data in combination with the planned WEAVE SCIP Cygnus High Resolution survey.
WEAVE is the next multi-object spectrograph at the 4.2 m William Herschel Telescope, whose first light is planned for summer 2020. It will provide high-quality spectra over the coming years for thousands of massive stars in the Galactic plane and, specifically, in several rich Cygnus OB associations. Combining the findings of recent research focused on the central Cygnus OB2 region, upcoming high-quality WEAVE data and the expected accuracy that Gaia will reach in the area, we will be able to perform the deepest multi-dimensional study ever done before in a massive star-forming complex. The results of this project will lead to an important improvement of our knowledge of star formation and evolution of star-forming regions and clusters, including our understanding of the dynamics and kinematics of OB associations and stellar groups and enlightening the role of the different evolutionary channels of massive stars, from their birth to their final fate.

Photometric observations of exoplanet candidates from Montsec

Enrique Herrero (ICE-IEEC)

In this talk I will present the Joan Oró robotic telescope from the Montsec Astronomical Observatory and shortly explain the rest of astronomy facilities at Montsec. The TJO, together with its main imager LAIA and the new intermediate resolution spectrograph ARES, represents a great tool to perform follow-up observations for space missions thanks to its robotic capabilities and its scheduling system. I will explain how the TJO is participating with photometric observations in the follow-up of exoplanet search projects like CARMENES and space missions like TESS. Our exoplanet observations at the TJO are mainly focused on the monitoring and characterization of activity in the host stars, and on the confirmation of exoplanet candidates through transit observations. I will explain how we schedule this type of observation and how we perform the data reduction.

Wide Binary and Multiple Systems of Bright Stars from Gaia-DR2 and the VO
Jiménez-Esteban, Fran M.; Solano, E.; Rodrigo, C. (CAB(INTA-CSIC)+)

We mined the recently published Gaia-DR2 catalog to identify bright comoving systems in the five-dimensional space (sky position, parallax, and proper motion), and used the analysis tools of the Virtual Observatory to characterize the comoving system members and to assess their reliability. In this talk I will present the resulting catalogue, which is already public through the VO (https://ui.adsabs.harvard.edu/abs/2019AJ....157...78J/abstract)

The use and potential of ESO facilities in connection with Gaia
Bruno Leibundgut (ESO)

This talk deals with the use and potential of ESO facilities in connection with Gaia.

Photometric calibration of multi-filter surveys: J-PLUS and J-PAS sinergies with Gaia
López-Sanjuan, Carlos on behalf of the J-PLUS and J-PAS collaborations (CEFCA)

The photometric calibration of large area surveys at 1% level is challenging both for J-PLUS and J-PAS (12 and 56 filters, conducted from OAJ) and for the spectro-photometry of Gaia DR3. We present the white dwarf (WD) locus technique, that it is able to provide absolute colour calibration in large area surveys such as Gaia without external observations of the calibration WDs. We also envision the prospects from J-PAS and its synergies with Gaia from the flux calibration and WD science point of view.

Synergies between Gaia and GALANTE
Jesús Maíz Apellániz and the GALANTE team (CAB(INTA-CSIC))

GALANTE is a high-dynamic-range seven-band optical photometric survey of the Galactic Plane that is being carried out from the T-80 at the OAJ in Teruel and will be expanded to the southern hemisphere using its Cerro Toll twin telescope. From its start, GALANTE was conceived as being based on Gaia, as its astrometry and photometry are calibrated that way. In the other direction, GALANTE has already helped the photometry of Gaia calibration and, in the future, will provide complementary information to the left of the Balmer jump and in crowded and nebulous regions. In this talk I will review the status of GALANTE and present the new results since the last meeting in 2018.

Source classification and the physical parameters in DR3

Minia Manteiga, C. Dafonte, D. Garabato, M.A. Álvarez-González, R. Santoveña-Gómez (Univ. La Coruña)

La próxima release de Gaia incluirá el trabajo de clasificación de fuentes y la obtención de parámetros astrofísicos que lleva a cabo CU8/DPAC. Esta clasificación está basada principalmente en la espectrofotometría BP/RP obtenida por el satélite, aunque también en otros datos internos a Gaia, como la astrometría y las velocidades radiales. En esta comunicación se resumen los principales productos que potencialmente se publicarán en DR3, en función de los resultados del proceso de validación previo.

Stellar atmospheric parameters of FGKM-type stars from high-resolution optical and near-infrared CARMENES spectra

Emilio Marfil, H. M. Tabernero, D. Montes, J. A. Caballero, M. G. Soto, J. I. González Hernández, A. Kaminski, E. Nagel, S. V. Jeffers, A. Reiners, I. Ribas, A. Quirrenbach, P. J. Amado (UCM+)

With the purpose of assessing classic spectroscopic methods on high-resolution and high signal-to-noise ratio spectra in the near-infrared wavelength region, we selected a sample of 65 F-, G-, and K-type stars observed with CARMENES, the new, ultra-stable, double-channel spectrograph at the 3.5 m Calar Alto telescope. We computed their stellar atmospheric parameters (Teff, logg, ξ, and [Fe/H]) by means of the StePar code, a Python implementation of the equivalent width method that employs the 2017 version of the MOOG code and a grid of MARCS model atmospheres. We compiled four Fe I and Fe II line lists suited to metal-rich dwarfs, metal-poor dwarfs, metal-rich giants, and metal-poor giants that cover the wavelength range from 5300 to 17100 angstroms, thus substantially increasing the number of identified Fe I and Fe II lines up to 653 and 23, respectively. We examined the impact of the near-infrared Fe I and Fe II lines upon our parameter determinations after an exhaustive literature search, placing special emphasis on the 14 Gaia benchmark stars contained in our sample. Even though our parameter determinations remain in good agreement with the literature values, the increase in the number of Fe I and Fe II lines when the near-infrared region is taken into account reveals a deeper Teff scale that might stem from a higher sensitivity of the near-infrared lines to Teff.
Additionally, we plan to give a summary of the preliminary results concerning the stellar atmospheric parameters (Teff, log g, [Fe/H]) of the CARMENES GTO M dwarfs by means of the spectral synthesis technique.

Stellar streams and other stellar substructures in the Milky Way with Gaia and JPLUS

David Martínez-Delgado (IAA)

A recent search for stellar tidal streams around Milky Way-like galaxies in the local Universe has revealed that some of these spectacular structures display outer, fuzzy and giant loops extending to the edge of the stellar halos. These stellar arcs are mainly composed of old stars unbound from the progenitor satellite long time ago, in comparison with the brighter, younger and inner stream arms similar those observed in the Sagittarius (Sgr) tidal stream in our Galaxy. The shapes and kinematic of these ancient debris would be very valuable to constrain the dark matter halos around their host galaxies.
These observations also suggest that our current knowledge about the full extension and dynamical history of the Sgr tidal stream could be not completed yet. However, these possible unknown pieces of Sgr stream would be situated at large galactocentric distance (100-200 kpc), what would be unfeasible to detect them with the current large scale photometry surveys data (e.g. SDSS, PanSTARRs, etc). In this talk, I discuss the previous evidence on the existence of an outer loop from the Sagittarius tidal stream and our new project to definitively trace these elusive pieces using a

comprehensive survey of the outer Galactic halo with J-PAS filters and the kinematic data from GAIA DR3.

WEAVE and Gaia, the 6D phase space
Maria Monguió (ICCUB)

WEAVE is a multifibre spectrograph being built for the William Herschel Telescope in La Palma. Its first light will be in summer 2020 followed by a 5 years survey using 70% of the time. The ING community can also access this instrument through the remaining 30% of the nights. With its great capabilities (950 MOS fibres, IFU modes, and two resolution modes R=5000 and 20000) WEAVE will become a key spectroscopic survey in the northern hemisphere, complementing the Gaia data with radial velocities and abundances. The most important technical aspects of the instrument will be reviewed, as well as the different surveys being planned by the consortium, paying special attention to the Galactic surveys. Those include scientific cases for the halo, the disc kinematics, open clusters, stellar and interstellar physics.

Widening Big data mining for astronomy
Roger Mor, X.Luri, et al. (ICCUB)

Data Mining tools have been very important in the last years for the scientific exploitation of astronomical data sets. Among others Data Mining and the Big data infrastructures have allowed us to reach very important scientific results. Such as, the discovery of many new open clusters and the determination of a non-parametric star formation history of the Milky Way disc.
However, nowadays the amount of data that is being generated for space and on ground missions is very large and astronomers need very large Clusters to analyse it. This reduces the number of scientific teams able to treat the data as a whole. One of the challenges for the coming years is to provide Big data mining tools to a wider community boosting the use of large data sets to produce scientific results. New infraestructures involving Cloud Computation services will be needed to face the scientific challenges of the near future

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Young clusters in the Gaia era: laboratories for massive star evolution
Ignacio Negueruela (Univ. Alicante)

Interest in massive stars has rekindled with the discovery of gravitational wave events and the realisation of the wide diversity among core-collapse supernova explosions. Young open clusters are our natural laboratories to explore the lives and deaths of massive stars, and most of our current understanding comes from their study. Nevertheless, we have been strongly limited by small number statistics, as most open clusters contain only a handful of evolved massive stars, while we have to probe a vast parameter space in terms of metallicity, age, initial rotational velocity and binary properties. Moreover, determination of accurate parameters for open clusters has always been difficult, because of the complex effects of interstellar extinction. The Gaia mission promises a global revolution for the study of open clusters. Exquisite proper motions can be used to determine bulk properties and identify large samples of certain cluster members. Accurate distances allow us to beat extinction and gain a much better handle on cluster age, Although the current DR2 is very limited for stars at distances higher than 1 kpc (i.e. for almost all young massive clusters), high-quality proper motions are already allowing major advances in the analysis: confirmation of membership for rare objects, identification of new clusters, internal dynamics, etc. I will present

some representative examples of the many ways in which Gaia data is furthering our knowledge of young open clusters and massive star evolution.

Ejected thermonuclear-supernova survivors in Gaia
Roberto Raddi (UPC)

Thermonuclear supernovae are expected to entirely disrupt an accreting white dwarf in a compact binary system. Recent observations have revealed a new class of objects -- LP 40-365 stars, after their prototype -- that may be the former accreting white dwarf that thermonuclear supernovae. Detailed spectral analysis reveals unusual atmospheres, entirely devoid of hydrogen and helium, and enriched with the nucleosynthetic ashes of partial O- and Si-burning. The large velocities of LP 40-365 stars, which are gained via the binary ejection mechanism, make them unbound to the Milky Way. Possible formation and evolution scenarios are discussed, including the prospects for future searches.

Swimming on a stellar stream: re-discovering the Sagittarius tails with Gaia.
Ramos, Pau; Antoja, T.; Mateu, C.; Helmi, A.; et al. (ICCUB+)

The sheer amount of data that current and future surveys are providing is making our simple models and assumptions insufficient. In order to answer questions such as “How did our Galaxy come to be?” or “What does the Milky Way (MW) look like?” we have to start taking into account the tangled nature of these systems. Since the MW was born, several dynamical mechanisms have been at work, interacting with each other and reshaping the phase-space in a way that we could easily interpret wrongly if not treated with care.
Particularly, the in-fall of the Sagittarius Dwarf Spheroidal (Sgr) has been responsible for a significant fraction of the substructure that we observe today. The Monoceros ring, thought to be the remnant of an accreted satellite, is now also being linked to the perturbation caused by the interaction with Sgr. Yet, there are still many questions open regarding its orbit and stellar content, which hinders our ability to constrain its effects on the MW.
In this talk I will present the largest sample of Sagittarius stars available to date, obtained entirely from Gaia DR2 proper motions alone. Up until now, we only had access to some line of sight velocities along the stream. Now, thanks to a smart use of the Archive combined with the Wavelet Transform, we have unveiled an almost 360º degrees continuous track of proper motions. To complement this data set, we have also re-discovered the stream within the Gaia table of RR Lyrae. The advantage of using RR Lyrae is that we gain access to the distances and, therefore, to the tangential velocities in km/s and also to the velocity dispersion of the progenitor. Apart from presenting both samples, I will also show the properties of the stream that we have derived.
This data will allow us to study in great detail the populations of Sagittarius, obtain the best possible orbit and, in turn, infer the properties of the gravitational potential of our Galaxy.

CTA and its synergies with Gaia
Marc Ribó (Universitat de Barcelona, ICCUB, IEEC-UB)

The Cherenkov Telescope Array (CTA) is the next generation ground-based observatory for gamma-ray astronomy. With one site in each hemisphere (the northern one being built in La Palma) CTA will provide in a few years from now a new and deep view of the non-thermal Universe in Very

High Energy (VHE) gamma rays. I will provide an overview of CTA and its Key Science Projects and I will discuss possible synergies with Gaia.

Characterising the Galactic warp with Gaia. Different approaches
Mercè Romero-Gomez, C. Mateu, L. Aguilar, F. Figueras, A. Castro-Ginard (ICCUB)

Gaia DR2 has opened the window to the possibility of exploring the outer disc of the Milky Way. Previous works using HI gas already suggested that the disc of the Galaxy is warped with a line-of-nodes close to the Sun - Galactic Centre line and bending downwards towards the 4th quadrant and upwards towards the 1st quadrant. Gaia Data Release 2 has provided a fabulous probe of millions of stars with astrometric information in order to test whether the Galactic warp is also present in the stellar component. Recent works have focused their efforts in trying to know whether the warp amplitude depends on the age of the tracer population, whether the warp structure is symmetric or lopsided, whether the line-of-nodes is straight, twisted or precessing. In this talk, I will review the most recent results Gaia data has provided in this aspect.

Ground-based observations of asteroids to support Gaia data exploitation
Toni Santana Ros (Universitat d'Alacant, ICCUB)

The Gaia mission is collecting an unprecedented amount of astrometric, photometric and spectroscopic data of asteroids. Its final catalogue will include, among other results, spin states and a first-order approximation of the shape for a number of the order of 100.000 asteroids. Our current analyses show that the algorithm used to derive these models (Cellino et al. 2006, 2009) has an ample margin of improvement and a great potential in combining ground-based light curves.
Automatic routines must be developed in order to detect interesting objects among the inversion results. For instance, we are currently developing the software needed to explore Gaia photometry to detect the anomalous signals related to the presence of binary asteroids. However, the observation timespan of DR2 is too short to obtain a unique inversion solution for a main belt asteroid.
This issue can be overcome by combining Gaia data with additional ground-based observations covering the missing ecliptic longitudes. For this purpose, we are currently using the 0.8 m Telescope Joan Oró (TJO) to gather data of selected targets. For fainter targets we also plan to use larger telescopes such as CAHA 2.2 m telescope or 2 m Liverpool telescope (IAC).

Galactic massive stars as seen by IACOB, Gaia and TESS
Sergio Simón-Díaz (IAC)

IACOB is an ambitious long-term observational project which main scientific goal is to provide a complete and statistically significant empirical overview of the main physical properties of Galactic massive O- and B-type stars. The ultimate objective of the project is that the compiled information can be used as a robust anchor point for our theories of stellar atmospheres, winds, interiors, and evolution of massive stars. In this endeavor, we are benefiting from: [1] optical, high-resolution spectroscopic facilities attached to 1-3 m telescopes in the Canary Islands observatories; [2] state-of-the-art tools and techniques to perform single snap-shot and multi-epoch quantitative spectroscopic analyses (and hence obtaining accurate estimates for the stellar/wind parameters, rotational velocities, abundances, as well as information about stellar phenomena giving rise to spectroscopic variability such as binarity, pulsations, rotational modulation, and wind variability); [3] empirical information about parallaxes and proper motions provided by the Gaia mission; and [4]

high cadence, uninterrupted photometry provided by space missions such as, e.g., Kepler/K2 and TESS. IIn this talk I will present an overview of the main results obtained up to date in the framework of the IACOB project putting special emphasis in highlighting the importance of the established synergies with the Gaia and TESS space missions.

The Virtual Observatory. A way to facilitate the synergies between Gaia and the ground-based facilities

Enrique Solano (CAB(INTA-CSIC))

Modern astrophysics is multiwavelength. A panchromatic view of astrophysical phenomena is required to properly understand the physics that is behind them. For many research lines, Gaia data must be complemented with existing information hosted in archives or with new data to be taken using other facilities. In both cases, the FAIR principle (Findable, Accessible, Interoperable, Reusable) must be fulfilled to ensure an optimum usage of the information. In this presentation I will describe how the Virtual Observatory can help to achieve this goal.

StePar/SteParSyn: two automatic codes to infer stellar atmospheric parameters

Hugo M. Tabernero **(Instituto de Astrofísica e Ciências do Espaço)**

StePar and SteParSyn are two codes designed to automatically infer the stellar atmospheric parameters of any FGKM-type star. StePar is Python 3.X code designed to compute the stellar atmospheric parameters Teff, log g, [Fe/H] of FGK-type stars by means of the equivalent width (EW) method. This code has already been extensively tested in different spectroscopic studies of FGK-type stars with several spectrographs and against thousands of Gaia-ESO Survey UVES U580 spectra of late-type, low-mass stars. SteParSyn is yet another automatic code designed to infer the stellar atmospheric parameters of FGKM stars using spectral synthesis alongside a Markov Chain Monte Carlo algorithm combined with a realist modelling of the stellar noise by means of Gaussian Processes.

DR3 cross-match and the HPM sources

Ferran Torra & Gaia UB Team (ICCUB-IEEC)

The cross-matching in Gaia is a sophisticated process that provides a consistent match between observations and sources in the working catalogue for subsequent data reduction processes.
Although the fraction of high proper motion stars that Gaia observes is small, their absolute number is not, and therefore the proper motion as well as other parameters have to be taken into account in the cross-matching of Gaia observations. We describe the improvements and the identification of new high proper motion sources thanks to a generalized algorithm based on clustering analysis.
Moreover, we analyse the source list evolution between DR2 and DR3 describing the main causes that lead to the Gaia DR3 identification and major parameters updates. Specifically, we analyse the evolution of the high proper motion sources in Gaia DR3.

The white dwarf population in the Gaia DR2 era

Santiago Torres, F. Jiménez-Esteban, A. Rebassa-Mansergas, E. Solano (UPC+)

White dwarfs are the most common remnants among the stellar objects. These objects, as being very old, carry a valuable information about the past history, formation and evolution of our Galaxy.

But its low intrinsic luminosity has hampered during decades to build statistically significant samples for its study. However, Gaia mission in its DR2 has provided an unprecedented wealth of information about the white dwarf population. Nearly 200,000 white dwarfs have been found, and close to 18,000 form a statistical complete sample up to 100 pc in the solar neighborhood. Thanks to novelty techniques, as the VOSA tools from the Virtual Spanish Observatory or Random Forest algorithms, it has been possible to obtain reliable distribution of stellar parameters or classify the population in its Galactic components. Several questions are still open and the undergoing analysis of the data will bring, without a doubt, new relevant findings in our understanding of the Galaxy.

Synergies between OAJ's surveys, J-PAS & J-PLUS, and Gaia

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Some of the possible synergies between the two main optical multi-filter surveys being conducted at the Observatorio Astrofísico de Javalambre (OAJ), J-PAS (56 narrow band filters) and J-PLUS (12 filters), and Gaia are explored. Even though they are driven by different main goals, there exists an non-negligible overlap or high complementarity potential between those ground-based projects and the Gaia mission, both in science cases (Galactic population classification, stellar atmospheric parameters determination, variability and transients, etc.) and on more technical aspects like objects classification and photometric calibration. Besides that, the OAJ facilities, as an ICTS, may offer good opportunities in particular Gaia science cases as well.
