Winter Meeting 2025

Report of Contributions

Contribution ID: **91**

Type: **not specified**

The Milky Way as a case study for Galactic Dynamics

Monday 3 February 2025 14:55 (25 minutes)

The Milky Way is a dynamic system, exhibiting a wealth of complex processes revealed through the unprecedented precision of ESA's Gaia mission. Gaia's stellar data provide a detailed window into the ongoing dynamical evolution of our Galaxy. For instance, the Galactic bar appears to be slowing down in its angular rotation, while the outer disc shows perturbations likely caused by the passage of the Sagittarius dwarf galaxy. These observational findings drive theoretical studies aimed at uncovering the underlying physics and improving our understanding of the Milky Way's structure and evolution. In this talk, I will present recent results from computer simulations of disc galaxies within a cosmological context, demonstrating how these tools help us interpret the intricate dynamics shaping our Galaxy.

Primary author: SEMCZUK, Marcin (Institut de Ciències del Cosmos, Universitat de Barcelona)

Presenter: SEMCZUK, Marcin (Institut de Ciències del Cosmos, Universitat de Barcelona)

Contribution ID: **92**
Type: **not specified**

Gravitational waves from collapsing domain wall networks in the early universe

Monday 3 February 2025 15:20 (25 minutes)

Unstable domain wall (DW) networks in the early universe are cosmologically viable and can emit a large amount of gravitational waves (GW), both before and during annihilation. In my talk I will present recent results on the form of the generated GW spectrum, based on lattice simulations of the field dynamics in 3+1-dimensions.

Primary author: TORRENTI, Francisco (ICCUB, U. Barcelona)

Presenter: TORRENTI, Francisco (ICCUB, U. Barcelona)

Contribution ID: **93**　　　　　　　　　　　　　　　　Type: **not specified**

Solving Einstein's Equations within Holography with Physics Informed Neural Networks

Monday 3 February 2025 14:30 (25 minutes)

Holography (or the gauge/gravity correspondence) refers to the dual description of the same phenomena through two seemingly different theories: quantum field theory in four dimensions ("our world") and gravity in five dimensions. In some regimes, holography gives us a map to solve within one of the descriptions (classical Einstein gravity in 5D Anti-de-Sitter spacetime) something that is very difficult to tackle in the other (some strongly coupled quantum field theory) with our current techniques. This map can be extremely difficult to establish; in our case, it involves solving nonlinear equations with inverse nature, something that traditional numerical methods are not able to do. I will present a new approach based on machine learning techniques, where a neural network is trained to solve these equations. Specifically, we use PINNs (Physics-Informed-Neural-Networks), in which the equations are embedded in the neural network structure itself.

Primary authors:　MATEOS, David (ICREA & U Barcelona);　TEJERINA PEREZ, Pablo (Institute of Cosmos Sciences of University of Barcelona (ICCUB));　Dr PROTOPAPAS, Pavlos (Harvard U.);　TARANCÓN ÁLVAREZ, Pedro (ICCUB);　Dr JIMENEZ, Raul (ICCUB & ICREA);　Mr LIU, Shuheng (Harvard U.);　Dr BEA, Yago (ICCUB)

Presenter:　TEJERINA PEREZ, Pablo (Institute of Cosmos Sciences of University of Barcelona (ICCUB))

Contribution ID: **94**   Type: **not specified**

Searching for Stellar Merger Precursors in the Milky Way

Tuesday 4 February 2025 10:00 (25 minutes)

The merger of binary systems has been identified as the cause of peculiar class of astrophysical transients discovered within the last three decades. Archival pre-outburst data on the progenitors of these transients showed an interesting fact: all but one were Hertzsprung gap stars undergoing a phase of fast expansion after hydrogen exhaustion in the core of the more massive component. This quick growth likely initiated an increasingly large mass transfer towards a nearby companion, ending in instability and eventual merger of the binary. Because of the short timescale of this phase, such binary configurations in pre-merger stage are rare. Understanding these binary progenitors is crucial for unraveling the mechanisms driving binary evolution and shedding light on the final fate of such systems.

In this presentation, I will discuss our current knowledge and hypotheses regarding these systems. Additionally, I will present our efforts to identify mass-transferring binaries within the Milky Way using data from Gaia and WISE, focusing on Hertzsprung gap stars sharing several properties with stellar merger progenitors.

Primary author: GARCIA MORENO, Gerard (Universitat de Barcelona)

Presenter: GARCIA MORENO, Gerard (Universitat de Barcelona)

Contribution ID: **95**   Type: **not specified**

Young(?) and (Metal-)Rich: The Puzzling RR Lyrae Stars in the Galactic Disk

Tuesday 4 February 2025 14:30 (25 minutes)

RR Lyrae stars are a class of variable stars whose luminosity varies periodically, with periods ranging from 0.2 to 1 day. The shape and properties of their light curves correlate with intrinsic characteristics such as luminosity and metallicity (in astrophysics, "metals" refer to all elements heavier than helium). For this reason, RR Lyrae stars are considered standard candles and have been used for decades to measure distances within the Milky Way and its surroundings. They are among the most studied and well-known variable stars, formed from old (>10 Gyr), metal-poor, and low-mass progenitors. Indeed, they are abundant in the oldest structures of our Galaxy, including the stellar halo, the bulge, and globular clusters. However, it is well-established that metal-rich RR Lyrae stars (with metallicities up to solar values) also exist in the Solar neighbourhood. Recent results from the European satellite Gaia have revealed that these metal-rich RR Lyrae stars are distributed across all the Galactic disk, extending well beyond the Solar vicinity. Their kinematics suggest an association with an intermediate-age Milky Way disk population, with ages estimated between 2 and 8 Gyr. These relatively young ages challenge conventional scenarios for RR Lyrae formation, which posit that such stars should be among the oldest in our Galaxy or even too old to exist at higher metallicities. Resolving this conundrum requires exploring alternative formation channels for RR Lyrae stars. One promising alternative formation channel involves mass transfer in binary systems (i.e., systems of two stars gravitationally bound to one another). My primary research focus at the ICCUB is to investigate this alternative formation channel using binary evolution simulations. In this talk, I will present the current state of knowledge on this intriguing problem, share my efforts to address it, and highlight its importance in the broader context of our understanding of the Milky Way and the theories of stellar and binary evolution.

Primary author: IORIO, Giuliano (University of Padova)

Presenter: IORIO, Giuliano (University of Padova)

Contribution ID: **96**   Type: **not specified**

Contributions of the Department of Electronic and Biomedical Engineering to the ICC

Monday 3 February 2025 10:25 (25 minutes)

Since the beginning of the ICC, members of the Department of Electronic and Biomedical Engineering has been collaborating with ICC researchers in different projects. This situation improved when they became members of the ICC starting on 2011. Since then, synergies in different fields have arose. This is a brief summary of the past, present and expected future.

Primary author: GOMEZ CAMA, Jose Maria

Presenter: GOMEZ CAMA, Jose Maria

Contribution ID: **97**
Type: **not specified**

Welcome

Monday 3 February 2025 10:00 (10 minutes)

Primary author: LURI, Xavier (ICCUB)

Presenter: LURI, Xavier (ICCUB)

Contribution ID: **98** Type: **not specified**

How can we help?

Monday 3 February 2025 10:10 (15 minutes)

Primary author: PALLARES, Esther

Presenter: PALLARES, Esther

Contribution ID: **99** Type: **not specified**

TBA

Primary author: GOMEZ CAMA, Jose Maria

Presenter: GOMEZ CAMA, Jose Maria

Contribution ID: **100** Type: **not specified**

TBA

Monday 3 February 2025 10:50 (25 minutes)

Primary author: BURNS, Anne-Katherine (ICCUB)

Presenter: BURNS, Anne-Katherine (ICCUB)

Contribution ID: **101** Type: **not specified**

TBA

Monday 3 February 2025 11:45 (25 minutes)

Primary author: BEA, Yago (ICCUB)

Presenter: BEA, Yago (ICCUB)

Contribution ID: **102** Type: **not specified**

TBA

Monday 3 February 2025 12:10 (25 minutes)

Primary author: GUBERMAN, Daniel (ICCUB)

Presenter: GUBERMAN, Daniel (ICCUB)

Contribution ID: **103** Type: **not specified**

TBA

Monday 3 February 2025 12:35 (25 minutes)

Primary author: Dr PORTELL DE MORA, Jordi (ICCUB)

Presenter: Dr PORTELL DE MORA, Jordi (ICCUB)

Contribution ID: **104**   Type: **not specified**

TBA

Primary author: TEJERINA PEREZ, Pablo (Institute of Cosmos Sciences of University of Barcelona (ICCUB))

Presenter: TEJERINA PEREZ, Pablo (Institute of Cosmos Sciences of University of Barcelona (IC-CUB))

Contribution ID: **105** Type: **not specified**

TBA

Primary author: SEMCZUK, Marcin (Institut de Ciències del Cosmos, Universitat de Barcelona)

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Contribution ID: **106** Type: **not specified**

TBA

Primary author: TORRENTI, Francisco (ICCUB, U. Barcelona)

Presenter: TORRENTI, Francisco (ICCUB, U. Barcelona)

Contribution ID: **107** Type: **not specified**

TBA

Monday 3 February 2025 16:15 (25 minutes)

Primary author: MORENO CARDONER, Maria

Presenter: MORENO CARDONER, Maria

Contribution ID: **108** Type: **not specified**

TBA

Monday 3 February 2025 16:40 (25 minutes)

Primary author: CLIMENT, Ana (ICCUB - Universidad de Barcelona)

Presenter: CLIMENT, Ana (ICCUB - Universidad de Barcelona)

Contribution ID: **109** Type: **not specified**

TBA

Monday 3 February 2025 17:05 (25 minutes)

Primary author: ORKNEY, Matthew (ICCUB (Universitat de Barcelona))

Presenter: ORKNEY, Matthew (ICCUB (Universitat de Barcelona))

Contribution ID: **110** Type: **not specified**

TBA

Primary author: GARCIA MORENO, Gerard (Universitat de Barcelona)

Presenter: GARCIA MORENO, Gerard (Universitat de Barcelona)

Contribution ID: **111** Type: **not specified**

TBA

Tuesday 4 February 2025 10:25 (25 minutes)

Primary author: HAMMOUD, Nadine (University of Barcelona, Faculty of Physics)

Presenter: HAMMOUD, Nadine (University of Barcelona, Faculty of Physics)

Contribution ID: **112** Type: **not specified**

TBA

Tuesday 4 February 2025 10:50 (25 minutes)

Primary author: KOMENDYAK, Mickael (ICCUB)

Presenter: KOMENDYAK, Mickael (ICCUB)

Contribution ID: **113** Type: **not specified**

TBA

Tuesday 4 February 2025 11:45 (25 minutes)

Primary author: COURBIN, Frederic (ICC - Universitat de Barcelona)

Presenter: COURBIN, Frederic (ICC - Universitat de Barcelona)

Contribution ID: **114** Type: **not specified**

TBA

Tuesday 4 February 2025 12:10 (25 minutes)

Primary author: GÓMEZ-VALENT, Adrià (ICCUB)

Presenter: GÓMEZ-VALENT, Adrià (ICCUB)

Contribution ID: **115** Type: **not specified**

TBA

Tuesday 4 February 2025 12:35 (25 minutes)

Primary author: ROZALÉN SARMIENTO, Javi (Universitat de Barcelona)

Presenter: ROZALÉN SARMIENTO, Javi (Universitat de Barcelona)

Contribution ID: **116** Type: **not specified**

TBA

Primary author: IORIO, Giuliano (University of Padova)

Presenter: IORIO, Giuliano (University of Padova)

Contribution ID: **117**　　　　　　　　　　　　　　　Type: **not specified**

TBA

Tuesday 4 February 2025 14:55 (25 minutes)

Primary author:　SALVADO, Jordi (University of Barcelona)

Presenter:　SALVADO, Jordi (University of Barcelona)

Contribution ID: **118**   Type: **not specified**

TBA

Tuesday 4 February 2025 15:20 (25 minutes)

Primary author: FRYCZ, Dorian (University of Barcelona)

Presenter: FRYCZ, Dorian (University of Barcelona)

Contribution ID: **119** Type: **not specified**

TBA

Tuesday 4 February 2025 16:25 (25 minutes)

Primary author: CAPDEVILA, Bernat (ICCUB)

Presenter: CAPDEVILA, Bernat (ICCUB)

Contribution ID: **120** Type: **not specified**

TBA

Tuesday 4 February 2025 16:50 (25 minutes)

Primary author: CALEFICE, Lukas (Universitat de Barcelona / ICCUB)

Presenter: CALEFICE, Lukas (Universitat de Barcelona / ICCUB)

Contribution ID: **121** Type: **not specified**

TBA

Tuesday 4 February 2025 17:15 (25 minutes)

Primary author: CASTRO-GINARD, Alfred (Universitat de Barcelona)

Presenter: CASTRO-GINARD, Alfred (Universitat de Barcelona)