



# Report WG2: The Life and Death of Stars

Gisella Clementini  
INAF – OAS, Bologna

The Milky Way Revealed by Gaia: The Next Frontier  
Barcelona, 5-7 September 2023

# WG 2 - The Life and Death of Stars

## WG2 Tasks:

- **WGT2a:** Stellar atmospheres and spectroscopy
- **WGT2b:** Stellar models and ages, 3D modelling of stellar interiors; modelling microscopic and macroscopic processes in stars
- **WGT2c:** Stellar clusters and stars with asteroseismic constraints as tests of the stellar evolution models, including standard candles of known distance such as Cepheids and RR Lyrae stars

# WG 2 - The Life and Death of Stars

175 (GP1) → 214 (GP4) subscribers

WG2 lead: **Gisella Clementini**

WG2 deputy: **Andrea Miglio**

**WG2 Kick-off meeting via teleconset: Sept 10, 2019**

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WG2 Tasks:

- **WGT2a:** Stellar atmospheres and spectroscopy

Task leads: **Maria Tsantaki & Ivanka Stateva**

- **WGT2b:** Stellar models and ages, 3D modelling of stellar interiors; modelling microscopic and macroscopic processes in stars

Task leads: **Marco Limongi & Nicolina Pop**

- **WGT2c:** Stellar clusters and stars with asteroseismic constraints as tests of the stellar evolution models, including standard candles of known distance such as Cepheids and RR Lyrae stars

Task leads: **Robert Szabo & Diego Bossini**

**WG2 Kick-off meeting via teleconset: Sept 10, 2019**

# WG2 activities: GP1

**WG2/WG3 Workshop:** ``*Frontiers of Stellar Physics: theory-observation interface*``  
**Zagreb (Croatia), 21-23 January 2020 – Lovro Palaversa convenor**

The aim of this workshop was to address the open questions related to the uncertainties in the theoretical models through a comparison with the observational data. Topics of the workshop included:

- **Population synthesis:** simulations of star counts, dependence on the uncertainties of the stellar models
- **Stellar rotation:** effects on the stellar evolution
- **Stellar pulsations:** comparison between the observational values and the theoretical light curves, luminosities, ages and colour
- **High-cadence space missions:** combining the Kepler, TESS and PLATO missions with Gaia and spectroscopic surveys to lift the degeneracies and provide key modelling parameters
- **Spectroscopy:** obtaining atmospheric parameters as a key ingredient of the models; Gaia benchmark stars
- **Stellar ages:** uncertainties in the models and their impact on the determination of ages
- **Asteroseismology:** importance of obtaining dynamical masses
- **Distance scale:** systematic errors in the determination of the distance scale as a result of the theoretical assumptions, ultimately affecting the determination of the Hubble constant

# WG2 activities: GP1

- **WG2/WG3 Workshop:**

*``Frontiers of Stellar Physics: theory-observation interface``*

**Zagreb (Croatia), 21-23 January 2020**

37 participants



<https://www.mw-gaia.org/participate/zagreb-wg2/>

# WG2 activities: GP2

- **WG1/WG2 online workshop: ``Star Clusters: the Gaia Revolution``**  
**Barcelona, 5-6-7 October 2021 – Tristan Cantat-Gaudin, Alfred Casro-Girand organizers**



The poster features a dark background with a field of stars and a large, bright yellow sun partially obscured by a dark silhouette of a galaxy or nebula. The text is arranged in a clean, modern layout.

**Star Clusters: the Gaia Revolution**  
MW-Gaia WG1/2 online workshop  
5-6-7 October 2021

**Invited Speakers:**  
Angela Bragaglia  
Laia Casamiquela  
Phillip Galli  
Marina Kounkel  
Andrea Miglio  
Eugene Vasiliev

**Scientific Organising Committee**  
Tristan Cantat-Gaudin  
Alfred Casro-Girand  
Nadège Lagarde  
Marco Limongi  
Šarūnas Mikolaitis  
Núria Miret Roig  
Elena Pancino  
Róbert Szabó

**Local Organising Committee**  
Lola Balaguer-Núñez  
Juan Carbajo  
Carme Jordi  
Esther Pallarés

**Logos:**  
MW Gaia, COST (EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY), ICCUB (EXCELENCIA MARIA DE MAEZTU 2020-2023, Institut de Ciències del Cosmos UNIVERSITAT DE BARCELONA), IECC (Institut d'Estudis Espacials de Catalunya)

## Main topics and invited speakers

Young stars and star forming regions - **Phillip Galli**

Stellar evolution and asteroseismology - **Andrea Miglio**

Data mining in the Gaia catalogue - **Marina Kounkel**

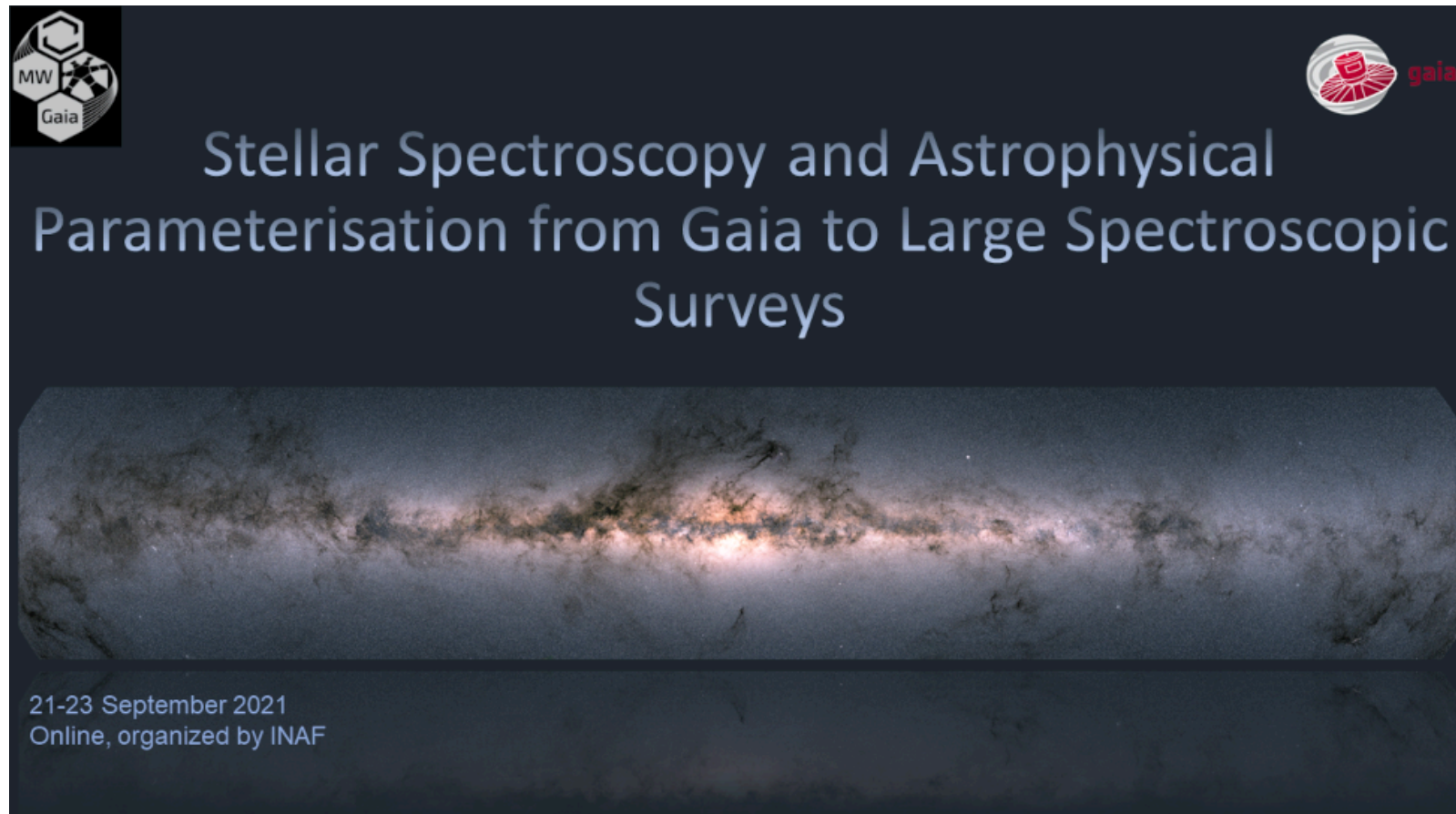
Cluster dynamics - **Eugene Vasiliev**

Chemistry and synergies with ground-based surveys - **Laia Casamiquela**

Clusters as tracers of the Galactic structure and history - **Angela Bragaglia**

# WG2 activities: GP2

- **WG2 online school:** `` *Stellar Spectroscopy and Astrophysical Parametrization from Gaia to Large Spectroscopic Surveys* ``  
**Padua, 21-23 September 2021 – Antonella Vallenari, Angela Bragaglia organizers**



The image is a promotional banner for an online school. It features a dark background with a horizontal view of the Milky Way galaxy. In the top left corner, there is a logo with 'MW' and 'Gaia' text. In the top right corner, there is a circular logo with a red and white design and the word 'gaia' next to it. The main title is written in large, light blue, sans-serif font across the top. At the bottom left, there is smaller white text providing the dates and organizer information.

**Stellar Spectroscopy and Astrophysical  
Parameterisation from Gaia to Large Spectroscopic  
Surveys**

21-23 September 2021  
Online, organized by INAF

## **Main subjects and speakers**

### *large spectroscopic surveys:*

**Angela Bragaglia, Elena Pancino, Antonella Vallenari**

*“classical” spectroscopic analysis (equivalent widths, spectral synthesis, differential spectroscopy):*

**Jorge Melendez, Chris Sneden, Maria Tsantaki, Sergi Blanco-Cuaresma**

*data driven methods: advantages and limitations:*

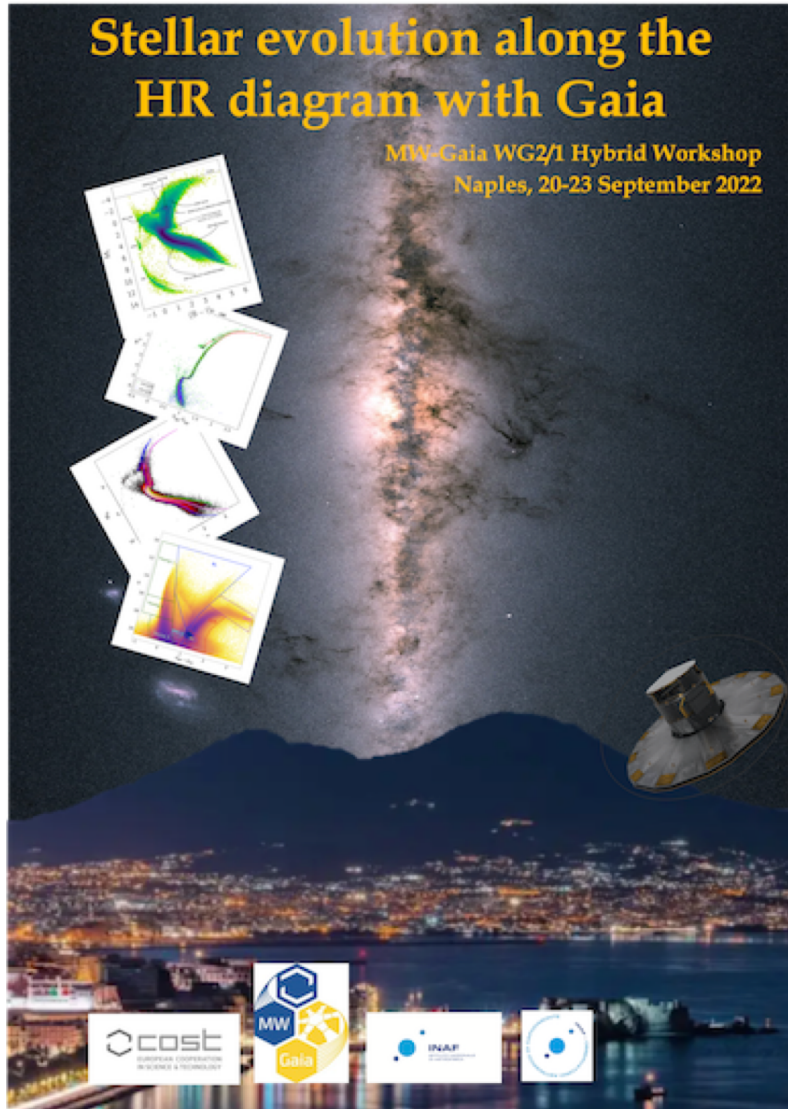
**René Andrae, Alejandra Recio-Blanco, Lorenzo Spina**

*publication skills:* **Chris Sneden**



# WG2 activities: GP3

- **WG2/WG1 Conference:** ``Stellar evolution along the HR diagram with Gaia``  
Naples (Italy), 20-23 September 2022 – Gisella Clementini, Marcella Marconi organizers



The meeting focussed on the Gaia crucial contribution to stellar evolution and our capability of modeling different stellar evolutionary phases, specifically addressing the impact on stellar models of new data products released with Gaia DR3.

## Main topics

- stellar evolution models;
- selected phases of stellar evolution;
- stellar pulsation models;
- asteroseismology;
- binary star evolution;
- synergies between Gaia and on-going/future spectroscopic surveys

## Invited speakers

R. Andrae, M. Barstow, M. Bellazzini, M. Bergemann, A. Brown, T. Cantat-Gaudin, S. Cassisi, S. Charpinet, G. De Somma, L. Eyer, N. Gentile Fusillo, O. Gonzalez, J. Isern, R. Izzard, G. Kordopatis, G. Kovacs, J. Maiz Apellaniz, P. Marigo, G. Meynet, J. Montalbán, S. Randich, A. Recio-Blanco, V. Ripepi, S. Van Eck

## WG2 activities: GP3

- **WG2/WG1 Conference:**

*``Stellar evolution along the HR diagram with Gaia``*

**Naples (Italy), 20-23 September 2022**

**65** participants in person – **206** registered participants in total  
**23** invited speakers - **22** contributed talks - **13** posters



<https://indico.ict.inaf.it/event/2023/registrations/834/>

## WG2 activities: GP3

- **WG2/WG4 hybrid workshop: ``Gaia and the Time Domain, capturing the transient sky``**  
**Coimbra (Portugal), 13-14 October 2022 – Sonia Anton, Gisella Clementini organizers**



# WG2 activities: GP4

**WG2 hybrid workshop: “Stellar Variability, Stellar Multiplicity: Periodicity in Time & Motion”**  
**Sofia, 6-8 June 2023 – Ivanka Stateva, Gisella Clementini organizers**



Stellar variability, intrinsic as in pulsating stars and extrinsic as in binaries, plays a crucial role in many fields of astrophysics, from stellar evolution, to the distance scale, to the study of structure and formation of the Milky Way. The workshop focussed on the impact that Gaia is having on a number of different fields addressed by stellar variability

## **Invited speakers**

B. Holl, M. Marconi, A. Garofalo,  
V. Belokurov, V. Ripepi, T. Lebzelter,  
J. Southworth, L. Mahy, A. Gallenne,  
E. Paunzen, Z. Nagy, I. Soszynski,  
Z. Ivezić, A. Mahabal

## WG2 activities: GP4

- **WG2 hybrid workshop:** *“Stellar Variability, Stellar Multiplicity: Periodicity in Time & Motion”*  
**Sofia, 6-8 June 2023**

**48** participants in person – **19** registered participants in total  
**14** invited speakers - **20** contributed talks – **9** posters



- Several STSM short visits on WG2 topics funded by the Action between July 2019 and Feb 2020 and later in 2022 – 2023 after the pandemia



**MW-Gaia COST Action CA18104**  
**Report WG2: The Life and Death of Stars**

**Thank You!**

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