

# FRANCESCA BORG

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## RESEARCH INTERESTS

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galactic dynamics – stellar populations – cosmology & dark matter – computational simulations

## RESEARCH EXPERIENCE

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**“Identification of streams in the Galactic halo by using RR Lyrae as stellar tracers” -**

**Università degli Studi di Roma Tor Vergata, University of Belgrade** Oct 2024 – present  
*M.Sc. thesis, Supervisors Prof. Giuseppe Bono, Asst. Prof. Stanislav Milosevic, Prof. Frederic Thevenin, Dr. Vittorio Braga, Dr. Michele Fabrizio*

We use a new catalog of RR Lyrae stars to characterize recently identified stellar streams observed within the Milky Way’s halo. Using their kinematic motions and spectroscopic observables, we investigate the 3D structure and origin of the stellar streams by further drawing a comparison with computational simulations of galactic mergers. Work on this project is still ongoing.

**“A risk assessment on exposure to radon in residential environments in Malta” - University of Malta**

Jul 2023 – Sep 2023

*Research support assistant for the National Commission for the Protection from Ionising and Non-Ionising Radiation, Supervisors Prof. Noel Aquilina, Dr Lourdes Farrugia*

In-depth analytical assessment of the risk of lung cancer posed to the Maltese population by indoor radon gas concentrations in residential dwellings, including an in-depth review of the literature as well as numerical computations using statistics on Maltese demographics and local trends in smoking habits and formal presentation of the findings to the Commission.

**“The stellar populations trapped at the L4/L5 Lagrange (corotation) points of a bar” - University of Malta**

Sep 2022 – Jun 2023

*B.Sc. thesis, Supervisors Prof. Joseph Caruana, Prof. Victor P. Debattista*

**Abstract:** Bars are prevalent features in disc galaxies and play an important role in driving secular evolution, especially through resonances. Stars at corotation resonance with the bar are known to librate around the stable Lagrange points (L4, L5). Here, we investigate the properties of corotating stars by performing an orbital frequency analysis on a subsample of stars in an N-body+SPH galactic simulation to obtain corotating and non-corotating subsamples. Trends in variation of ages and metallicities are investigated by sectioning the galactic plane into radial and azimuthal bins, and comparing the properties of both categories of stars within each bin, using a K-S test to check statistical significance. We confirm the existence of important systematic differences between the distributions of the ages and metallicities of the corotating stars with respect to the surrounding non-corotating stars. Trends in age are found to vary radially and suggest that corotating stars are dragged away from the corotation radius in both directions, whereas the metallicities of stars in corotation are found to be distinctly higher.

**Galactic simulations research project - University of Malta**

Jul 2021 - Sep 2021

*Supervisors Prof. Joseph Caruana, Prof. Victor P. Debattista*

Processing and analysis of a galactic simulation using Python, particularly PyNbody and AGAMA packages. Tasks included rendering galactic components, extracting statistics from data to produce plots, and identifying and analysing trends.

## CAREER & EDUCATION

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<b>Master in Astrophysics and Space Science (EMJM MASS)</b>	<i>Sep 2023 – present</i>
S1 Università degli Studi di Roma Tor Vergata, Italy	27/30
S2 University of Belgrade, Serbia	10/10
S3 University of Belgrade, Serbia	<i>ongoing</i>
<b>Bachelor of Science (B.Sc.) (Hons) in Mathematics and Physics</b>	<i>Sep 2019 – Jul 2023</i>
Faculty of Science, University of Malta, Malta	First Class Honours
<b>ERASMUS Exchange in Mathematics, Physics, Astrophysics</b>	<i>Sep 2021 – Jun 2022</i>
School of Mathematics, Cardiff University, UK	A+

## SELECTED SEMINARS, WORKSHOPS & INTERNATIONAL CONFERENCES

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### Attended seminars and talks:

<b>ERIS 2024</b> , Granada (Spain)	<i>30 Sep – 4 Oct 2024</i>
The tenth edition of the European Radio Interferometry School.	
<b>MASS Summer School 2024</b> , Université Côte d’Azur (France)	<i>15 – 19 Jul 2024</i>
“Observational astronomy and data processing”.	
<b>7th Institute of Space Sciences (ICE-CSIC) Summer School</b> (Spain)	<i>2 – 11 Jul 2024</i>
“Multiwavelength Approach to Exoplanets”.	
<b>Gravitational Wave Open Data Workshop #7 (2024)</b> , GWOSC	<i>18 – 20 Apr 2024</i>
Crash-course in gravitational-wave data analysis.	
<b>MASS Winter School 2023/2024</b> , Università degli Studi di Roma Tor Vergata	<i>15 – 19 Jan 2024</i>
“From Stars to Cosmic Explosions: Bridging Scales in Astrophysical Data Analysis”.	

### Contributed seminars and talks:

<b>ICPS 2024</b> , Free University of Tbilisi (Georgia)	<i>4 – 11 Aug 2024</i>
Poster presentation of undergraduate thesis “The stellar populations trapped at the L4/L5 Lagrange (corotation) points of a bar”.	
<b>XIII SAW</b> , Astronomical Society “Ruđer Bošković” (Serbia)	<i>18 May 2024</i>
Talk presenting undergraduate thesis “The stellar populations trapped at the L4/L5 Lagrange (corotation) points of a bar” at the 13 <sup>th</sup> Student’s Astronomical Workshop.	
<b>Short Review Paper Seminar</b> , University of Malta	<i>22 May 2023</i>
Talk presenting short review paper titled “First light and the James Webb space telescope”.	
<b>Physics Seminar and Poster Session</b> , University of Malta	<i>18 – 19 May 2023</i>
Talk and poster presentation of undergraduate thesis “The stellar populations trapped at the L4/L5 Lagrange (corotation) points of a bar”.	
<b>S-Cubed’s Annual Science Conference</b> , University of Malta	<i>19 Apr 2023</i>
Talk presenting undergraduate thesis “The stellar populations trapped at the L4/L5 Lagrange (corotation) points of a bar”.	

## HONORS & AWARDS

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- ICPS Participation Fee Waiver Award for attending ICPS 2024.
- Erasmus Mundus Joint Master (EMJM) scholarship for MASS (2023 – 2025 entrance).
- Certificate of Merit in recognition of high quality of research in undergraduate thesis (2022 – 2023).
- Dean’s List for the Faculty of Science in recognition of academic achievement during academic years 2021 – 2022 and 2022 – 2023.

## TECHNICAL STRENGTHS

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<b>Programming</b>	Python, Java
<b>Software &amp; Tools</b>	L <sup>A</sup> T <sub>E</sub> X, Linux OS, SQL, Mathematica, Excel
<b>Languages</b>	Maltese (Native), English (Native), German (B1), Italian (A1)

## MENTORSHIP & TEACHING EXPERIENCE

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- Summer term English and Maltese reading teacher at Maria Regina College Qawra Primary School (St. Paul's Bay, Malta) (Jul – Sep 2022).
- Volunteer tutor at Dar Merhba Bik, helping residing children with studies and homework (Hal Balzan, Malta, Oct 2017 – Apr 2018).

## VOLUNTEERING & OUTREACH

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- Volunteer representative of the Institute for Space Sciences and Astronomy (ISSA) at the open day for secondary schools organised by the University of Malta (Msida, Malta, Dec 2022).
- Volunteer o.b.o the Department of Mathematics running the department's stand with mathematics-based games at the Science in the City festival (Valletta, Malta, Sep 2022).
- Environmental activist volunteer o.b.o the European Solidarity Corps, working in collaboration with the Municipality of Geraci Siculo, to preserve the village's open spaces and create an environmental awareness campaign aimed towards the locals (Sicily, Italy, Jul – Aug 2022).
- Mediterranean Youth Mathematical Championship (MYMC) participant as part of the national Maltese team (Napoli, Italy, Jun 2019).
- Childcare support volunteer at the Ursuline Sisters' Orphanage (Sliema, Malta, Jun – Sep 2018).
- Volunteer camp leader o.b.o the Little Sisters of The Poor, responsible for organizing and leading activities, entertainment and field trips during a summer day camp for children (Armagh, Northern Ireland, Jun – Jul 2018).