



Gabriele Bertinelli

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EDUCATION

•Master's Degree in Physics of Data

2023 - Ongoing

University of Padova, Italy

•Bachelor's Degree in Astronomy

2019-2022

University of Padova, Italy

THESIS

•Bachelor's Thesis

Title: *"DART mission to the Didymos binary system"*

– Supervisor: Prof. Monica Lazzarin

– Description: The purpose of this thesis is to describe the DART mission to the Didymos binary asteroid system. To do this we start with a general description of asteroids and then move on to binary systems, important scientific targets for studying the formation and evolution of asteroids and shedding light on the evolutionary aspects of the Solar System itself. The discussion will then shift to the modalities and purposes of the DART mission, the first mission with the goal of testing a planetary defense system against potentially dangerous bodies. The system of (65803) Didymos, the target of the DART and Hera missions, will be discussed, discussing its dynamical, morphological and spectroscopic characteristics. Finally, the first results produced by the observational campaigns, terrestrial and space-based, that began immediately after the probe's impact with the asteroid Dimorphos will be described.

PROJECTS ACCOMPLISHED DURING THE MASTER'S DEGREE

•Implementation of [fireworks](#) Python module, Plummer sphere evolution, code optimization

2024

The project was proposed for my master's courses of 'Computational Astrophysics'

– Tools: Python, N-body simulations, Computational Astrophysics

– Goal of this project is the development of a N-body simulation Python module. Using [fireworks](#), we studied the evolution of different realization of star clusters drawn from a Plummer sphere in virial equilibrium. The cluster was evolved in orbit in a point mass potential. We analyzed the leading and trailing tidal arms and the 'tidal radius criterion' effectiveness in selecting the stars belonging to the cluster. Alongside with the simulation, we explored ways to optimize the N-body simulation code using GPUs and multi-threading and multi-processing on CPUs.

•[Hierarchical Mergers](#) of Binary Black Holes

2024

The project was proposed for my master's courses of 'Laboratory of Computational Physics - A'

– Tools: Python, Jupyter Notebook, Binary Evolution, [SEVN](#), Machine Learning

– Goal of this project is to understand the differences between hierarchical binary black hole mergers in NSCs, GCc and YSc, by looking at a set of simulated BBHs. Our analysis was carried out with classification ML algorithms, such as Random Forest and XGBoost. We proceed to analyze the importance of features to understand the properties of systems of BBHs.

•[Dormant Black Holes in Binaries](#) from Gaia DR3

2023

The project was proposed for my master's courses of 'Laboratory of Computational Physics - B'

– Tools: Python, Jupyter Notebook, Binary Evolution, [SEVN](#), Machine Learning

– We explored the evolution of binary systems containing a black hole and a main sequence star using Binary System Evolution (BSE) simulations and machine learning techniques. Using a rapid binary population-synthesis code, SEVN, we simulated the evolution of these systems and compared the results to the observed properties of known binaries. Machine learning techniques were employed to identify the key factors influencing the evolution of these systems.

•Streaming processing of cosmic rays using Drift Tubes detectors

2023

The project was proposed for my master's courses of 'Management and Analysis of Physics Dataset'

- Tools: Python, Kafka, pySpark, Bokeh
- Goal of this project is to reproduce a real-time processing of real data collected in a particle physics detector and publish the results in a dashboard for live monitoring.

•Bayesian Blocks algorithm implementation in R

2023

The project was proposed for my master's courses of 'Advanced Statistics for Physics Analysis'

- Tools: R, Jupyter Notebook, Bayesian Inference
- Using the R program language, a Bayesian Block algorithm implementation has been developed and tested on light curve of Supernovae explosion.

WORKSHOPS

•International workshop on Machine Learning in Astronomy

National Center for Big Data and Cloud Computing

2023

•Gravitational Wave Open Data Workshop

GWOSC

2023

EXPERIENCES

•Science communicator

2017 - Ongoing

Link2Universe

- Editor and admin of one of the largest Italian space-related outreach pages. Publication of space, astrophysics and science news on [Facebook](#), [Instagram](#) and [Telegram](#).

•Observations at 'Copernico' telescope

October 2022

Asiago Observatory - INAF OAPd

- Tools: telescope observations, Python, IRAF, DS9
- I spent three nights (October 17-19th 2022) at the Asiago Observatory, on behalf of Prof. Monica Lazzarin, observing the Dydimos system after the DART impact. I collected both photometric and spectroscopic data. I also performed a quick data cleaning and analysis using IRAF routines.

INTERESTS

I am an astrophysicist with a strong interest in observational astrophysics, particularly focused on *minor bodies* and planetary science. My journey as a student (and aspiring researcher) is driven by a deep curiosity in harnessing the power of *machine learning* techniques in the field of astrophysics. In addition, I have a strong affinity for data science, which complements my analytical skills.

Areas of Interest: Minor bodies, Planetary science, Machine Learning, N-Body simulations

LANGUAGES

•Italian

Native

•English

Full professional proficiency

TECHNICAL SKILLS

Languages: Python, SQL, R, Bash, IRAF

Operating Systems: Windows, Linux

Developer Tools: Jupyter Notebook, VSCode, Git, GitHub, GitLab

Frameworks: Apache Spark, Kafka, Dask

Container Applications: Docker

Visual Communication: L^AT_EX, Markdown, MO Power Point, MO Word

Editing softwares: Adobe Premiere Pro, Adobe Photoshop, Adobe Lightroom

Soft Skills: Team work oriented, Time management, Organization skill, Autonomous work