

Feliciano Sapio



Title

General Relativity with the two Galileo satellites DORESA and MILENA

Abstract

G4S_2.0 is a new project funded by the Italian Space Agency which aims to perform measurements in the field of Fundamental Physics with two satellites, DORESA and MILENA, of the Galileo-FOC constellation.

These satellites are characterized by the high eccentricity of their orbits and the accuracy of their atomic clocks. For these characteristics, they have recently been used to improve a previous measurement of gravitational redshift (GRS) by Gravity Probe-A in 1980 ([1]). GRS, which is a local position-invariance test, is only one of the predictions of General Relativity (GR) that can be tested with the Galileo constellation. In particular, the G4S_2.0 project aims to provide a new measurement of GRS and to measure relativistic precessions of the elliptical orbits. These results will place new constraints on possible alternative theories of gravitation, both metric and non-metric in their structure. Furthermore, constraints on the presence of Dark Matter in our Galaxy can be placed by analyzing the data of the constellation's atomic clocks.

In this framework a fundamental point is obtaining a satellite orbit solution precise as far as possible. For this purpose, we focus firstly on the precise orbit determination and on a dynamic model for the non-conservative forces acting on these satellites. In particular, the model manages the perturbing effects produced by the direct solar radiation pressure (the major perturbation), the Earth's infrared radiation and the Earth-albedo.

The results of G4S_2.0 project will extend the number of tests of Einstein's Theory of GR that can be achieved with Galileo satellites.

[1] Vessot R.F.C. et al., (1980) Test of relativistic gravitation with a spaceborne hydrogen maser. Phys Rev Lett 45(26):2081–2084. [https://doi.org/ 10. 1103/ Phys. Rev. Lett. 45. 2081.](https://doi.org/10.1103/Phys.Rev.Lett.45.2081)

PERSONAL INFORMATION

Feliciana Sapio



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Gender Female | Date of birth 17/02/1996 | Nationality Italian

CURRENT EMPLOYMENT / OCCUPATIONAL FIELD

PhD student-ASTRONOMY, ASTROPHYSICS AND SPACE SCIENCE at University of Rome “Sapienza” and IAPS (Istituto di Astrofisica e Planetologia Spaziali) in Rome.

EDUCATION AND TRAINING

21-10-2020

Master's degree in Physics (LM), LM-17- CLASS OF MASTER'S DEGREES IN PHYSICS, curriculum ASTROPHYSICS.

University of Naples Federico II

Master's thesis in Astrophysics entitled “*Study of the correlated matter distribution around massive galaxy clusters*” with final grades 110/110 cum laude.

Principal subjects/occupational skills covered:

In-depth knowledge of modern astronomy and astrophysics with an emphasis on experimental, technological and theoretical observational aspects.

In particular, during the thesis work I studied weak gravitational lensing and analyzed data related to galaxy clusters through programs developed in Python.

17-01-2018

Degree in Physics Class N.L-30-Class of the degrees in Physical Sciences and Technologies-D.M 270/2004.

University of Naples Federico II

Thesis in Astrophysics entitled “*The component of dark matter in elliptical galaxies*” with final grades 110/110.

Principal subjects/occupational skills covered:

In-depth knowledge of the basic fields of classical and modern Physics, familiarity with the scientific method of investigation as well as team work.

In particular, during the thesis work I studied and applied the strong gravitational lensing as an observational technique in the investigation of dark matter. For this purpose, I also used the Lenstool application that allows to model the mass distribution of any strong lensing system.

July 2014

High School diploma

Liceo scientifico “Cristoforo Colombo”- Marigliano - Naples

Final grade: 100/100 cum laude

Principal subjects/occupational skills covered:

Solid general and scientific culture, acquisition of scientific methods and development of

valid logical-interpretative and communication skills.

SPACE MISSIONS, PROJECTS AND EXPERIMENTS

- G4S_2.0 (Galileo for Science) financed by ASI (Agenzia Spaziale Italiana)
- SaTor-G (Satellites Tests of Relativistic-Gravity) financed by INFN (Istituto Nazionale di Fisica Nucleare)/CSN2

GRANTS AND AWARDS

- 16-12-2021 **“Migliori Comunicazioni” Società Italiana di Fisica (107th National Congress)**
The talk entitled "The Galileo for Science (G4S_2.0) project: Fundamental Physics experiments with the Galileo satellites DORESA and MILENA" is selected by the Scientific Committee as "Migliori Comunicazioni" and it will be published in a special booklet of the international review "Il Nuovo Cimento" guaranteeing an online publication in open access.
- 11-11-2020 **Winner of the 36th cycle admission to PhD courses academic year 2020/2021**
University of Rome "Sapienza".
Grant INAF (Istituto Nazionale di AstroFisica) - IAPS (Istituto di Astrofisica e Planetologia Spaziali): "European GNSS Galileo as an infrastructure for Fundamental Physics experiments and Cosmology; current applications and future developments"
- 29-10-2020 **Winner of the 36th cycle admission to PhD courses academic year 2020/2021**
University of Florence.
- 2-04-2019 **Assigned grant from SHANGHAI NORMAL UNIVERSITY. DM 1047 DEL 29/12/2017 - MOBILITY FOR THESIS RESEARCH ABROAD**
International Relations Office of University of Naples Federico II
Because of the Covid-19 emergency, the undersigned could not benefit from the experience related to the grant.

SCIENTIFIC DISSEMINATION

Years 2015- 2021

- Member of Lazio-Committee for the Astronomy Olympiad
- Coordinator of the cultural association "Gruppo Astrofili Marigliano" which is a group of astronomy amateurs.
- Speaker at the events UAI (Unione Astrofili Italiani) "La notte dei congiunti", "La festa dell'Equinozio", "Astri del Ciel"
- Astronomic observations using telescopes promoted by cultural association "Oltremarigliano"
- Attendance at the event "Futuro Remoto" (two editions) held in Piazza Plebiscito in Naples with the Association of Social Promotion "Ponys APS" (Physics & Optics Naples Young Student)
- Attendance at the event "Passione Fisica" in "Città della Scienza" in Naples with the Association of Social Promotion "Ponys APS" (Physics & Optics Naples Young Student)

TEACHING ACTIVITIES

- Year 2021 Astronomy Olympiad 2022 (an astronomy contest for middle school and high school students) at the "Istituto di Astrofisica e Planetologia Spaziali" (IAPS-INAF). The team is in charge both of organising astronomy lectures and preparing, marking exercises.

- 19-12-2018 **24 ECTS as in D.M 10 August 2017, n. 616, for teaching qualification**
 University of Naples Federico II
 Principal subjects/occupational skills covered:
 Knowledge of the basic elements of Pedagogy and Psychology and related teaching skills in Mathematics and Physics.

CONFERENCES AND WORKSHOP

- Conferences as presenter
 13-17 September 2021 **107th National Congress of Società Italiana di Fisica (SIF) (virtual)**
 The talk entitled "The Galileo for Science (G4S_2.0) project: Fundamental Physics experiments with the Galileo satellites DORESA and MILENA" is selected by the Scientific Committee as "Migliori Comunicazioni" and it will be published in a special booklet of the international review "Il Nuovo Cimento" guaranteeing an online publication in open access

- Conferences as coauthor
 - XXIII Conference of the Italian Society of General Relativity and Gravitation (SIGRAV), 7-9 September 2021, Urbino, Italy.
 - 16th Marcel Grossmann Meeting, 5-8 July 2021 (virtual)
 - virtual European Geodesy Union 2021 (vEGU21), 27-28-29 April 2021

- Courses
 - Budgeting Science the funds Universe: Importance in research and Innovation (10 h, April-May 2021, Consiglio Nazionale delle Ricerche (CNR))
 - Communicating your results to your colleagues and the public (10 h, April-May 2021, Università degli Studi di Roma "Tor Vergata")
 - Soft Skills Courses for PhD formation (19 h, November-December 2021, Università degli Studi di Roma "Sapienza")

PERSONAL SKILLS AND COMPETENCES

Mother tongue Italian

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	B2	B2	B2	B2	B2
	<ul style="list-style-type: none"> • EDI Level 1 Certificate ESOL International JETSET Level 5 (CEFR B2) • Trinity College London Grade 8 Graded Examination in Spoken English B2.2 of the CEFR 				

French	A2	A2	A2	A2	A2
DELFA2					

Computer skills and competences

- a good knowledge of Windows and Ubuntu operating systems
- a good competence of Microsoft Office suite tools (word-processor, spreadsheet, presentation software)
- a good competence of Python and Latex languages
- a good knowledge of Matlab

11-06-2009 Certificate ECDL (European Computer Driving Licence)
From AICA (Italian Association for Information Technology and Computing Promotion)

Other Skills I used to play sports competitively (swimming, volleyball and dance)

Driving License B