



UNIVERSITÀ
DI TRENTO

Dipartimento di
Fisica



PhD Program in Space Science and Technology - SST

With great precision comes great responsibility: the challenges of gravitational wave observations of Intermediate and Extreme Mass Ratio Inspirals

Specific Seminar – Curriculum 8

May 27, 2026, 3 p.m.

Speaker:

Lorenzo Speri - Postdoctoral Research Fellow at the European Space Agency (ESTEC), The Netherlands

Abstract:

The future mission Laser Interferometer Space Antenna (LISA) will open the millihertz gravitational-wave sky for the first time, transforming space into a precision laboratory for relativistic astrophysics. Among its most remarkable targets are Intermediate and Extreme Mass Ratio Inspirals (IMRIs and EMRIs): compact objects slowly spiraling into massive black holes at the centers of galaxies. These systems complete hundreds of thousands of relativistic orbits in the strong-field regime before merger, encoding an exquisite map of the surrounding spacetime in their gravitational-wave phase. In this talk, I will explore how to unlock the scientific promise of these sources, and why doing so is far from trivial. I will first discuss the theoretical challenge of modeling their dynamics with sufficient accuracy. Then, I will turn to data analysis: how to identify long-lived information-rich signals, and which statistical strategies can robustly extract their parameters. Finally, I will highlight the physics at stake—precision measurements of black hole masses and spins, tests of theories of gravity, and insights into the astrophysical environments of galactic nuclei.

Short Bio

Lorenzo Speri is a Postdoctoral Research Fellow at the European Space Agency (ESTEC). His research focuses on developing advanced methods to extract scientific information from gravitational-wave observations of LISA, Pulsar Timing Arrays, and ground-based detectors.

Website: <https://lorenzsp.github.io/index.html>

Bibliography

Single-harmonic search for extreme mass-ratio inspirals, Speri et al. 2026, Physical Review D, Volume 113, Issue 2, id.024061, 17 pp.

Probing Fundamental Physics with extreme mass-ratio inspirals: Full Bayesian inference for scalar charge, Speri et al. 2026, Physical Review D, Volume 113, Issue 2, id.023036, 18 pp.

Online attendance:

Information on remote participation can be requested by sending an e-mail to dn_sst@unitn.it