Sam Imperato

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Citizenship: United States
Research interests: Observational cosmology, using astronomical surveys and statistical inference to investigate fundamental physics, including dark energy, dark matter, and gravity.

Education and Employment

Queen Mary University of London, London, UK — September 2025 – June 2027 (expected)
MSc Physics (Euromasters), Astrophysics Track
Global Talent Scholarship, taught module average 85.9% (Distinction)

Royal Observatory Greenwich, London, UK — December 2023 – August 2025
Planetarium Astronomer

Harvard College Observatory, Cambridge, MA, USA — August 2023 – November 2023
Plate Stacks Curatorial Assistant

Northwestern University, Evanston, IL, USA — September 2018 – June 2022
BA Physics, Astronomy Concentration, Minor in Data Science

Research Experience

MSc Thesis: Field-Level Inference for Relativistic Effects in LSS — May 2026 – Present
Astronomy Unit, Queen Mary University of London, London, UK
Supervisor: Prof. Chris Clarkson

- Investigated field-level inference methods to constrain relativistic effects in large-scale structure.
- Developed a Fourier-space field-level likelihood and forward model for Doppler distortions.
- Reconstructed 3D peculiar velocity fields from halo density fields using linear theory.
- Validated the pipeline using catalogue velocities and recovered the expected Doppler amplitude.

Research Fellow — May 2023 – August 2023
Institute for Astrophysical Research, Boston University, Boston, MA, USA
Supervisor: Prof. JJ Hermes

- Developed MESA white-dwarf models and used GYRE to simulate asteroseismic oscillations.
- Compared theoretical oscillation modes with observations of pulsating white dwarfs.

Undergraduate Researcher — September 2018 – June 2022
CIERA, Northwestern University, Evanston, IL, USA
Supervisor: Prof. Vicky Kalogera

- Developed a computational pipeline for modelling low-mass X-ray binary formation and evolution.
- Used population synthesis, analytic orbital dynamics, and MESA 1D mass transfer simulations.
- Compared simulated populations with observed X-ray binaries to constrain black hole natal kicks.
- Pipeline subsequently applied in an analysis resulting in a second-author ApJL publication.

International REU Student in Gravitational Physics — June 2021 – September 2021
Università di Roma "La Sapienza", Rome, IT
Supervisor: Dr. Pia Astone

- Analysed LIGO gravitational-wave data using MATLAB to search for continuous-wave signals.
- Applied signal-processing techniques to identify weak signals embedded in large datasets.
- Modelled continuous gravitational-wave emission from known pulsars.

Publications

C. Kimball, **S. Imperato**, V. Kalogera et al. (2023), *A Black Hole Kicked At Birth: MAXI J1305-704*, *The Astrophysical Journal Letters* 952, L34 arXiv:2211.02158

The LIGO Scientific Collaboration and Virgo Collaboration (including **S. Imperato**):
Tests of General Relativity with Binary Black Holes from the Second LIGO-Virgo Gravitational-Wave Transient Catalog, *Physical Review D* 103, 122002 (2021) arXiv:2010.14529
Population Properties of Compact Objects from the Second LIGO-Virgo Gravitational-Wave Transient Catalog, *The Astrophysical Journal Letters* 913, L7 (2021) arXiv:2010.14533
GWTC-2: Compact Binary Coalescences Observed by LIGO and Virgo During the First Half of the Third Observing Run, *Physical Review X* 11, 021053 (2021) arXiv:2010.14527
Gravitational-wave Constraints on the Equatorial Ellipticity of Millisecond Pulsars, *The Astrophysical Journal Letters* 902, L21 (2020) arXiv:2007.14251

Coursework Projects

Estimating Quasar Redshifts from DESI DR1 Spectra January 2026 – April 2026
Deep Learning Module, Queen Mary University of London, London, UK

- Designed and trained a 1D CNN to predict quasar redshifts from DESI spectra.
- Predicted redshifts to within $|\Delta z| < 0.1$ for 91% of a held-out test set and identified $z > 2.1$ quasars with 98.7% precision and 93.8% recall.

Technical Skills

Programming: Python (pandas, NumPy, Matplotlib, Astropy, SciPy), R, MATLAB, Fortran, C.
Computing: Git, SLURM, Bash, Unix.
Astronomy Software: CAMB, Pylians, MESA, GYRE, COSMIC PopSynth, TOPCAT, DS9.
Machine Learning: TensorFlow/Keras, scikit-learn.
Data Analysis: Bayesian inference, statistical modelling, data visualisation.
Languages: Native English speaker, proficient in Italian, beginner in French.

Teaching and Mentoring

Teaching Fellow September 2022 – May 2023
Boston University, Boston, MA, USA

- Led laboratory, observing, and discussion sessions for undergraduate courses *The Astronomical Universe* and *Life Beyond Earth*.
- Held office hours and graded coursework and examinations.

Research Supervisor for High School Students June 2020 – May 2023
SUNY Science Research, Pelham Memorial High School, Pelham, NY, USA

- Designed and supervised high-school research projects using publicly available astronomical datasets.
- Supervised student whose project qualified for International Science and Engineering Fair (ISEF).

Science Communication and Outreach

Planetarium Astronomer December 2023 – August 2025
Royal Observatory Greenwich, London, UK

- Created scientifically accurate visualisations of astrophysical phenomena using planetarium and animation software.
- Developed planetarium shows communicating complex scientific concepts to diverse audiences.
- Presented live astronomy shows to public and school audiences.
- Trained new presenters and line-managed a team of five part-time staff.

Plate Stacks Curatorial Assistant August 2023 – November 2023
Harvard College Observatory, Cambridge, MA, USA

- Hosted public exhibitions on the history of women in astronomy at Harvard College Observatory.
- Conducted archival research using historic astronomy collections to support curatorial projects.
- Digitised astronomy glass plate negatives for DASCH: Digital Access to a Sky Century @ Harvard.