Stefano Torniamenti

Postdoctoral researcher

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Oct. 2019 -
Apr. 2023
PhD student in Astronomy, *University of Padua cum laude*.
PhD project title: Unveiling the dynamics of young star clusters and their black hole population. Supervisor: Prof. Michela Mapelli. Co-supervisors: Dr. Alessandro Ballone and Dr. Mario Pasquato.

Jan. - July
2022
Visiting researcher, *Institut de Ciències del Cosmos, Universitat de Barcelona (ICCUB)*.
Supervisor: Prof. Mark Gieles.

Oct. 2016 -
Feb. 2019
Master student in Physics, *University of Milan, 110/110 cum laude*.
Thesis title: Energy equipartition and mass segregation in globular clusters. Supervisor: Prof.Giuseppe Bertin. Co-supervisor: Prof. Claudio Grillo.
Average class grade: 30/30 with 8/12 distinctions ("cum laude").

Oct. 2012 -
Feb. 2016
Bachelor student in Physics, *University of Milan, 110/110 cum laude*.
Thesis title: Study of the presence of a black hole in an ultra-compact dwarf galaxy.
Supervisor: Prof. Giuseppe Bertin

Academic positions

Jan. 2023 -
Postdoctoral researcher, ERC consolidator DEMOBLACK, *University of Padua*.

Honors/Awards

Fondazione Ing. Aldo Gini Fellowship.
Fellowship awarded by Fondazione Ing. Aldo Gini to spend a period of research abroad. Fellowship amount: 4600€.

Erasmus+Traineeship Scolarship.
Scolarship awarded by the Erasmus programme to carry out a period of research abroad. Scolarship amount: 2100€.

Accepted computational proposals

Principal
Investigator
PRACE DECI−17 proposal, *StarCluBin*.
7.52M standardised hours awarded for $N-$body simulations on the Snellius Tier-1 supercomputer at SURFsara.

Principal Investigator	**ISCRA C (CALL 84C) proposal**, *The impact of hydrodynamical initial conditions on N-body simulations.* **32k** CPU hours awarded for N-body simulations on the MARCONI100 Tier-0 cluster at CINECA.

External Funding

co-I	**PRIN INAF (200k EUR for 3 years) 2022**, *Title: Pulsar/black-hole systems and other jewels in the casket of globular cluster stellar populations*, PI: Andrea Possenti; co-PIs: Michela Mapelli, Cristina Pallanca.
co-I	**PRIN MIUR (577.5k EUR for 3 years) 2021**, *Title: Multimessenger astronomy in the Einstein Telescope Era (METE)*, PI: Marica Branchesi; co-PIs: Enrico Cappellaro, Michela Mapelli, Michele Punturo, Success rate: 9.5%.
Grant	**IAU Grant (260 EUR)**, *Grant awarded to participate to the IAU Symposium 351 & MODEST 19.*

Conferences & Seminars

Invited talks

3rd-7th Jul. 2023	**A multi-wavelength view on globular clusters near and far: from JWST to the ELT**, Sexten, Italy. Invited talk: "Globular clusters and their black hole population in the era of gravitational-wave astronomy".
20th Apr. 2023	**Seminar at IAC**, La Laguna, Spain (online seminar). Invited talk: "A new generative model for star clusters from hydro-dynamical simulations".
24th Jan. 2023	**Seminar at SISSA**, Trieste, Italy. Invited talk: "Formation channels of binary black holes in young star clusters".
22nd Febr. 2022	**Seminar at Université de Montréal (UdeM)**, Montréal, Canada (online seminar). Invited talk: "Star cluster formation: towards generative models".

Contributed talks

11th-15th Sep. 2023	**Two in a million - The interplay between binaries and star clusters**, Garching, Germany. Contributed talk: "Star Clusters and the Nursery of Binary Black Holes".
5th-7th Sep. 2023	**MWGaia COST ACTION Final conference: "The Milky Way Revealed by Gaia: The Next Frontier"**, Barcelona, Spain. Contributed talk: "Unveiling black holes in open clusters".
28th Aug. -1st Sep. 2023	**MODEST-23: Star Clusters in the Post-Pandemic Era**, Evanston, USA. Contributed talk: "Star Clusters and the Nursery of Binary Black Holes".

26th-30th Jun. 2023	**The Renaissance of Stellar Black-Hole Detections in The Local Group**, Leiden, The Netherlands. Contributed talk: "Black holes in the Hyades cluster".
14th-25th Nov. 2022	**MIAPbP - The Fundamental Role of Stellar Multiplicity in Stellar Dynamics and Evolution**, Garching, Germany. Contributed talk: "Formation channels of binary black holes in young star clusters".
26th-30th Sep. 2022	**International conference PUMA22 - Probing the Universe with Multimessenger Astrophysics**, Sestri Levante, Italy. Contributed talk: "Binary black hole mergers in young star clusters".
25th-28th Apr. 2022	**AAS 53rd Annual Meeting of the DDA**, Flatiron Institute, New York. Contributed talk: "Formation channels of binary black hole mergers in young star clusters".
9th-12st Nov. 2021	**IAU Symposium 362**, *"Predictive Power of Computational Astrophysics as a Discovery Tool"*, online edition. Contributed talk: "A novel generative method for star clusters from hydro-dynamical simulations".
28th Oct. 2021	**TEONGRAV Seminar**, online seminar. Contributed talk: "The impact of star cluster dynamics on binary black hole mergers".

Posters

11th-15th Sep. 2023	**Two in a million - The interplay between binaries and star clusters**, Garching, Germany. Poster: "Unveiling black holes in open clusters".
27th Jun. - 1st Jul. 2022	**European Astronomical Society Annual Meeting 2022**, Valencia, Spain. **Poster:** "Formation of young stellar clusters from turbulent molecular clouds". Poster: "Formation channels of BBH mergers in young star clusters".
28th Jun. - 2nd Jul. 2021	**European Astronomical Society Annual Meeting 2021**, online edition. Poster: "Evolution of binary populations in young stellar clusters".
9th-11th Mar. 2021	**55th Rencontres de Moriond 2021**, *Gravitation session*, online edition. Poster: "The effect of dynamics on BBH populations".
27th-31st May 2019	**IAU Symposium 351 & MODEST 19**, *"Star Clusters: from the Milky Way to the Early Universe"*, Bologna, Italy. Poster: "A simple two-component description of mass segregation for anisotropic globular clusters".

Teaching experience

Teaching assistant

Oct. 2021 - Jan. 2022	**Assistant for the course: Computational astrophysics**. Master in Astrophysics and Cosmology, University of Padova.
Oct. 2021 - Jan. 2022	**Assistant for the course: Experiments in physics 1**. Bachelor in Physics, University of Padova.

Supervising

Apr. - Dec. 2022	**Master student advisor (Francesco Flora), University of Padova, Italy**.
	Thesis title: "Eccentricity evolution of binary black holes in globular clusters"
Jun. - Sep. 2021	**Bachelor student advisor (Nicolò Belgiovine), University of Padova, Italy**.
	Thesis title: "Hierarchical black hole mergers in stellar clusters"

Outreach

Sep. 2021	**Researchers Night - VenetoNight 2021**, *Padova*.

Press Releases

8th Sep. 2023	**New results hint at the existence of the closest Black Holes to Earth in the Hyades star cluster**, *by Institute of Cosmos Sciences (ICCUB)*.
	Press release link

Referee work

2023	Reviewer for the Czech Science Foundation.

IT knowledge

Programming and scripting

Excellent	pyhton, C++, Wolfram Mathematica, python scientific packages (numpy, panda, scipy, matplotlib).
Good	BASH scripting, Octave/Matlab, SQL, R.

Machine learning platforms

Excellent	SciKit-Learn, Keras, TensorFlow.

Software and Utilities

Excellent	LaTeX, Google suite, Office suite (Microsoft office, LibreOffice), GitHub, GitLab, Dropbox, Google suite.
Good	Geopandas, Folium.

Operating systems

Excellent	Windows, Linux.

Code developer

Fastcluster	population-synthesis code for binary black hole dynamics in star clusters. Public version: [this link](). The new version I implemented will be available soon (Mapelli et al. 2021, Torniamenti et al. in prep.).

Advanced code user

NBODY6++GPU	direct $N-$body code, available at [this link](#) (Wang et al. 2015).
PeTar	direct $N-$body code, available at [this link](#) (Wang et al. 2020).
MOBSE	population-synthesis code, available at [this link](#) (Giacobbo et al. 2018).
clusterBH	semi-analytic model for evolving star clusters, available at [this link](#) (Antonini & Gieles 2020).
HiGPUs	direct N-body code (Capuzzo-Dolcetta et al. 2012).
McLuster	tool to make a star cluster, available at [this link](#) (Küpper et al. 2011).

Computing experience

Experience in high-performance and parallel computing (OpenMP).

Experience in GPU computing (CUDA parallel architecture).

Certifications

TensorFlow	online four-course professional certificate "DeepLearning.AI TensorFlow Developer", authorized by DeepLearning.AI and offered through Coursera. Certificate ID: RDFVAFGVHL4T.
Deep Learning	online five-course specialization "Deep Learning Specialization", authorized by DeepLearning.AI and offered through Coursera. Certificate ID: GNQPK68F5MM9.
Machine Learning	online course "Machine Learning", authorized by Stanford University and offered through Coursera. Certificate ID: GVNYVMDL23DU.
SQL	online data science courses offered by Kaggle. Courses: **Intro to SQL** ([course certificate](#)), **Advanced SQL** ([course certificate](#)).

Language skills

Italian	Native speaker.
English:	Fluent.
French:	Intermediate.

Language certifications

English	IELTS (2019) - Grade 7.5 (CEFR: C1).

Schools and Workshops

1st-5th Jun, 2021	**Summer School in Statistics for Astronomers XVI**, *Online school.* Week-long virtual Summer School in statistical methodology for astronomy offered by Penn State's Center for Astrostatistics.

1st-5th Feb. **SIGRAV International School 2021**, *Online school.*
2021   School about Physics and Astrophysics of compact objects in the context of General Relativity, organised by the Italian Society of General Relativity and Gravitation (SIGRAV).

14th-23rd Jan. **MMSchool Asiago 2020**, *Asiago.*
2020   First Padova Excellence School of Multi-Messenger astrophysics, organized by the Department of Physics and Astronomy (DFA) of the University of Padova.

7th - 9th Jun. **First ML-INFN Hackathon**, online edition.
2021   First edition of the Machine Learning INFN (ML_INFN) starting level hackathon.

Affiliations and Memberships

DEMOBLACK   I am actually a member of the ERC funded Demoblack group, led by prof. Michela Mapelli at the University of Padova.

INAF   I am currently affiliated to the Istituto nazionale di astrofisica, in the Padova section.

INFN   I am currently affiliated to the Istituto Nazionale di Fisica Nucleare, in the Padova section. In particular, I am member of the TEONGRAV (TEoria delle ONde GRAVitazionali) group that studies the gravitational wave Emission from astrophysical sources.

EAS   I am currently member of the European Astronomical Society.

Publications

ORCID ID: 0000-0002-9499-1022

Data from SAO/NASA Astrophysics Data System.

Refereed pubblications

2023 **Torniamenti S.**, Gieles M., Penoyre Z., Jerabkova T., Wang L., Anders F., *Stellar-mass black holes in the Hyades star cluster?*, 2023, MNRAS, 524, 1965, https://arxiv.org/abs/2303.10188.

2022 **Torniamenti S.**, Rastello S., Mapelli M., Di Carlo, U.N., Ballone, A., Pasquato, M., *Dynamics of binary black holes in young star clusters: The impact of cluster mass and long-term evolution*, 2022, MNRAS, 517, 2953, https://arxiv.org/abs/2203.08163.

2022 **Torniamenti S.**, Pasquato M., Di Cintio P., Ballone, A., Iorio G., Artale, M.C., Mapelli, *Hierarchical generative models for star clusters from hydro-dynamical simulations*, 2022, MNRAS, 510, 2097, https://arxiv.org/abs/2106.00684.

2021 **Torniamenti S.**, Ballone, A., Mapelli, M., Gaspari, N., Di Carlo, U., Rastello, S., Giacobbo, N., Pasquato, M., *The impact of binaries on the evolution of star clusters from turbulent molecular clouds*, 2021, MNRAS, 507, 2253, https://arxiv.org/abs/2104.12781.

2019 **Torniamenti S.**, Bertin G., Bianchini P., *A simple two-component description of energy equipartition and mass segregation for anisotropic globular clusters*, 2019, A&A, 632, A67. https://arxiv.org/abs/1909.13093.

2023 Rastello S., Iorio G., Mapelli M., Arca Sedda M., Di Carlo U. N., Escobar G. J., Shenar T., **Torniamenti S.** *Dynamical formation of Gaia BH1 in a young star cluster*, accepted for publication in MNRAS. https://arxiv.org/abs/2306.14679

2023 Ballone A., Costa G., Mapelli M., MacLeod M., **Torniamenti S.**, Pacheco-Arias J. M., *Formation of black holes in the pair-instability mass gap: Hydrodynamical simulations of a head-on massive star collision*, 2023, MNRAS, 519, 5191, https://ui.adsabs.harvard.edu/abs/2022MNRAS.tmp.3494B/abstract.

2021	Di Carlo U. N., Mapelli M., Pasquato M., Rastello S., Ballone A., Dall'Amico M., Giacobbo N., Spera M., Iorio G., Spera M., **Torniamenti S.**, Haardt F., *Intermediate mass black holes from stellar mergers in young star clusters*, 2021, MNRAS, 507, 5132, https://arxiv.org/abs/2105.01085.
2021	Rastello S., Mapelli M., Di Carlo U. N., Iorio G., Ballone A., Giacobbo N., Santoliquido F., **Torniamenti S.**, *Dynamics of binary black holes in low-mass young star clusters*, 2021, MNRAS, 507, 3612, https://arxiv.org/abs/2105.01669 .
2021	Mapelli M., Dall'Amico M., Bouffanais Y., Giacobbo N., Spera M., Bouffanais Y., Arca Sedda M. , Artale M. C., Ballone A., Di Carlo U. N., Iorio G., Santoliquido F., **Torniamenti S.**, *Hierarchical black hole mergers in young, globular and nuclear star clusters: the effect of metallicity, spin and cluster properties*, 2021, MNRAS, 505, 339. https://arxiv.org/abs/2103.05016 .
2021	Ballone A., **Torniamenti S.**, Mapelli M., Di Carlo U. N., Spera M., Rastello S., Gaspari N., Iorio, G., *From hydrodynamics to N-body simulations of star clusters: mergers and rotation*, 2021, MNRAS, 501, 2920. https://arxiv.org/abs/2012.00767.
2020	Di Carlo U. N., Mapelli M., Giacobbo N., Spera M., Bouffanais, Y., Rastello S., Santoliquido F., Pasquato M., Ballone A., Trani A. A., **Torniamenti S.**, Haardt F., *Binary black holes in young star clusters: the impact of metallicity*, 2020, MNRAS, 498, 495. https://arxiv.org/abs/2004.09525.
2020	Ballone A., Mapelli M., Di Carlo U. N., **Torniamenti S.**, Spera M., Rastello S., *Evolution of fractality and rotation in embedded star clusters*, 2020, MNRAS, 496, 49. https://arxiv.org/abs/2001.10003.

Full list of refereed publications available at: this link

Submitted papers

2023 - submitted	Dall'Amico M., Mapelli M., **Torniamenti S.**, Arca Sedda M., *Eccentric black hole mergers via three-body interactions in young, globular and nuclear star clusters*, submitted to MNRAS. https://arxiv.org/abs/2303.07421.

Contributions to conferences and symposia

2023 - proceedings	**Torniamenti S.**, *A novel generative method for star clusters from hydrodynamical simulations*, 2022, Proceedings of the International Astronomical Union (IAU) - IAU Symposium 362. https://arxiv.org/abs/2210.04848.
2020 - proceedings	**Torniamenti S.**, Bertin G., Bianchini P., *A simple two-component description of mass segregation for anisotropic globular clusters*, 2020, Proceedings of the International Astronomical Union (IAU) - IAU Symposium 351 & MODEST-19, Cambridge University Press. https://arxiv.org/abs/1909.07221.

Full list of non-refereed publications available at: this link