Taj Jankovič, PhD

Curriculum vitae

Department of Astroparticle Physics
Elementary Particle Physics Section
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Research profile

My interest is focused on simulations of high-energy astrophysics phenomena, including stellar tidal disruption events (TDEs) and quasi-periodic eruptions (QPEs). I am proficient in the hydrodynamics in general relativity and modelling stars with realistic density profiles. I significantly contributed to the understanding of debris evolution after the stellar disruption, specifically the return rate of the debris and the effect of the black hole's rotation on the subsequent debris evolution. Due to this, I am on track to becoming an internationally recognized researcher in this field. During PhD, I developed strong proficiency in numerical codes, especially those based on the smoothed-particle-hydrodynamics method that incorporates general relativistic hydrodynamics.

Education

2019-2023 **Ph.D. in Astrophysics**, *University of Nova Gorica*, Nova Gorica, Slovenia (final grade: 9.7/10)
Thesis: "Relativistic Tidal Disruptions of Realistic Stars by Supermassive Black holes"
Supervisor: Prof. A. Gomboc (University of Nova Gorica, Nova Gorica, Slovenia)
Co-supervisor: Asst. Prof. C. Bonnerot (University of Birmingham, Birmingham, UK)
Successfully defended on: August 24th, 2023

2016-2019 **M.Sc. in Physics**, *University of Ljubljana*, Ljubljana, Slovenia (final grade: 9.7/10)
Thesis: "On the Fate of Stars After a Tidal Disruption Event"
Advisor: Prof. A. Gomboc (University of Nova Gorica, Nova Gorica, Slovenia)
Awarded on: September 12th, 2019

2012-2016 **B.Sc. in Physics**, *University of Ljubljana*, Ljubljana, Slovenia (final grade: 7.8/10)
Thesis seminar: "Space-time ripples"
Advisor: Prof. A. Gomboc (University of Nova Gorica, Nova Gorica, Slovenia)
Awarded on: September 20th, 2016

Research experience

2023-2024 **Postdoctoral fellow (Marie Curie COFUND)**, Department of Astroparticle Physics, *Institute of Physics of the Czech Academy of Sciences*, Prague, Czech Republic

2023-2024 **Research assistant**, Center for Astrophysics and Cosmology, School of Science, *University of Nova Gorica*, Nova Gorica, Slovenia

2019-2023 **PhD student**, School of Science, *University of Nova Gorica*, Nova Gorica, Slovenia

Memberships

2023-present **Member of the European Astronomical Society**, an intergovernmental organisation of 22 member states dedicated to the exploration of space

Member of the WG1 of GWverse COST Action, a collaboration focusing on supermassive black holes, relativistic numerical relativity of astrophysical gas and plasma, and observations of transients

Grants and exchanges

09/2021 **STSM funded by the COST Action CA16104: GWverse**
I was awarded funding for a visit to the Niels Bohr Academy (Copenhagen, Denmark) as the Short Term Scientific Mission. This visit made possible the start of the collaboration with Dr. Bonnerot.

2017 **Erasmus exchange, Astronomy department, Stockholm University, Sweden**
During a 4-month exchange, I significantly improved my knowledge in astrophysics, including hydrodynamics by successfully completing the course Astrophysical Gas Dynamics (lecturer Prof. Stephan Rosswog).

Numerical expertise

Methods Expertise in Lagrangian general relativistic-hydrodynamics codes (Phantom) and stellar evolution codes (MESA, MESA2HYDRO)

Languages Fortran 90, Mathematica, Python, and Latex

Outreach and media activities

06/2025 **Movie** prepared for the "Science Fair" event in Prague

06/2025 **Interview** titled "Plimska raztrganja zvezd" for the Italian radio station *Trst A*

09/2022 **Presentation** titled "Center for astrophysics and cosmology" to elementary school students at the University of Nova Gorica, Ajdovščina, Slovenia

08/2022 **Presentation** titled "Black holes and tidal disruption events" to high school students at the GoChile summer school, Ajdovščina, Slovenia

03/2021 **Interview** titled "Virus ne gane črnih lukenj" for the Slovenian national newspaper *Delo*

01/2021 **Presentation** titled "Black holes and tidal disruption events" to high school students at the Informativa Fair, online

11/2020 **Presentation** titled "Black holes, stellar tidal disruption events and other points of interest in astronomy" to general public at the European researcher's night, online

09/2020 **Interview** titled "Iskanje življenja onkraj Zemlje" for the Slovenian national radio station *RTV*

05/2019 **Presentation** titled "On the fate of stars after a tidal disruption event" to students at the First meeting of the CEEPUS network, Vipava, Slovenia

Teaching and supervision

2023-present **Supervision** of a PhD student Mario Andrés Osvaldo Aguilar Faúndez
In April 2023, I began supervising the student in the context of TDE simulations with the Phantom code.

2023-2024 **Supervision** of a bachelor student Aleksej Jurca
I supervised the student as a part of the Diploma seminar:
https://repozitorij.ung.si/IzpisGradiva.php?id=9171&lang=slv

2019-2024 **Teaching assistant** for the bachelor-level course "Stellar astrophysics 2"

2020-2023 **Teaching assistant** for the bachelor-level course "Stellar astrophysics 1"

Publications

6. Jankovič, T., et al., "Radiation-hydrodynamics of star–disc collisions for quasi-periodic eruptions", 2026, submitted to A&A

- Code and data: https://github.com/tajjankovic/Radiation-hydrodynamics-of-star-disc-collisions/
- Movies of simulations: https://www.youtube.com/playlist?list=PLH8qhWjKWQ92nPx_tPaPYnobRCPUjlfdF

5. Jankovič, T., et al., "Astrometry-only detection of microlensing events with Gaia", 2025, A&A, 699, A156

- Code and data: https://github.com/tajjankovic/GAME-Filter

4. Bronikowski, M.;…;**Jankovič, T.**., "Cluster-lensed supernova yields from the Vera C. Rubin Observatory and Nancy Grace Roman Space Telescope", 2025, A&A, A&A, 697, A146

3. Jankovič, T., **Bonnerot, C.**, Gomboc, A., "Spin-induced offset stream self-crossing shocks in tidal disruption events", 2024, MNRAS, 529, 673–687

- Code and data: https://github.com/tajjankovic/Spin-induced-offset-stream-self-crossing-shocks-in-TDEs
- Movies of simulations: https://www.youtube.com/channel/UCcfg9AxruBie2pjTt0w34CA

2. Jankovič, T., Gomboc, A., "The mass fallback rate of the debris in relativistic stellar tidal disruption events", 2023, ApJ, 946, 25

- Code and data: https://zenodo.org/record/7428262

1. Jankovič, T., "Space-time ripples". Matrika: selected topics in modern physics and mathematics, 2017, ISSN 2385-8567, Vol. 4, Issue 1, 10 pages

Talks and posters

09/2025 **Talk "Radiation-hydrodynamics of star-disc collisions"**, Conference: "Tatra Astro Summit", Stará Lesná, Slovakia

06/2025 **Talk "Radiation-hydrodynamics of star-disc collisions"**, Conference: "X-ray Quasi-Periodic Eruptions & Repeating Nuclear Transients", Madrid, Spain

05/2025 **Lecture "Mysterious X-ray Flares Near Black Holes: Are They Caused by Star-Disc Collisions?"**, Event: "Astrodebata", University of Ljubljana, Ljubljana, Slovenia

01/2024 **Talk "Spin-induced offset stream self-crossing shocks in tidal disruption events"**, Conference: "Transients Down Under", Melbourne, Australia

09/2023 **Talk "Spin-induced offset stream self-crossing shocks in tidal disruption events"**, LSST Conference: "Towards LSST science, together!", Poreč, Croatia

03/2023 **Talk "Spin-induced offset stream self-crossing shocks in tidal disruption events"**, Mini TDE Workshop, Columbia University, New York, USA

11/2022 **Talk "The mass fallback rate of the debris in relativistic stellar tidal disruption events"**, 12th Slovenian conference on basic research in physics, Terme Čatež, Slovenia

10/2022 **Talk "The mass fallback rate of the debris in relativistic stellar tidal disruption events"**, Transient sky with Gaia: MW-Gaia WG2-WG4 Workshop, University of Coimbra, Coimbra, Portugal

06/2022 **Virtual poster presentation "Relativistic tidal disruptions of stars with realistic density profiles"**, European Astronomical Society EAS 2021: Annual Meeting, Leiden, Netherlands

01/2020 **Poster presentation "Bound debris in stellar TDEs"**, Tidal disruptions in Kyoto: confronting theory with observations, Kyoto University, Kyoto, Japan