Sashwat Tanay

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Google Scholar, LinkedIn

EDUCATION

Ph.D. (Physics) University of Mississippi 2016-2022
Advisor: Prof. Leo C. Stein
Dissertation: Post-Newtonian Dynamics of Eccentric, Spinning Binary Black Holes and the Associated Gravitational Waveforms

B.Tech. (Mechanical Engineering) Indian Institute of Technology (IIT) Ropar 2009-2013

EMPLOYMENT

Postdoctoral Fellow LUX, Paris Observatory - PSL University 2023-2025

Adjunct Instructor University of Mississippi 2022-2023

Teaching and Research Assistant University of Mississippi 2016-2022

Junior Research Fellow Tata Institute of Fundamental Research, Mumbai 2013-2015

AWARDS & FELLOWSHIPS

PSL Postdoctoral Fellowship, Paris Observatory - PSL University 2023-2025

FGSA Travel Award for Excellence in Graduate Research, APS ($500) 2022

Graduate School Honors Fellowship, Univ. of Mississippi ($12,000 in total) 2016-2020

Junior Research Fellowship, Tata Institute of Fundamental Research, Mumbai 2013-2015

RESEARCH INTERESTS

A total of 10 research papers (published and in prep.), plus 1 set of lecture notes, supplemented by computer codes on GitHub.

• Gravitational waves (GWs) • Post-Newtonian (PN) dynamics of binary black holes (BBHs) • Quasi-normal mode (QNM) ringdown of black holes (BHs) • Hamiltonian dynamical systems • Extreme mass ratio inspirals (EMRIs)

TEACHING EXPERIENCE

Phys 211 Instructor of record Summer 2023
(Adjunct Instructor, Univ. of Mississippi; course website here & lecture notes here)
- Developed and taught a calculus-based undergraduate physics course
- Created course material (including lecture notes), delivered lectures and assessed student performance

Phys 221, 222, 223, 224 Undergrad physics lab courses 2016-2022
(Teaching Assistant, Univ. of Mississippi)
- Taught undergraduate physics lab courses. Conducted lab sessions, and graded assignments

MENTORING

Supervision of 3 mentees have resulted in 3 research papers (one published and two in prep.), and that of a 4^{th} mentee into an undergrad thesis.

Tom Colin (postgrad, Ecole Normale Supérieure, Paris) led to Publications (1) & (2) — Oct 2023-present

Manuel Alva (undergrad, Universidad Nacional de Trujillo, Peru) led to Publication (2) — Nov 2023-present

Rickmoy Samanta (postdoc, ISI Kolkata) led to Publication (4) — Sep 2021-Sep 2022

Pranav Kasetty (undergrad thesis co-advisor, IISc Bengaluru) — Oct 2021-Apr 2022

TECHNICAL SKILLS

- Numerical computing, analytical calculations, approximate solutions of differential equations using perturbative methods
- Machine learning & data in Python with scikit-learn, Keras, and TensorFlow
- **Computer:** Mathematica (xAct), C/C++, Python, Fortran, Matlab, Jekyll (web development), Bash, GitHub profile

PROFESSIONAL SERVICE

Referee Physical Review & Physical Review Letters — Feb 2023-present

LANGUAGES

Fluent: English, Hindi **Elementary:** French (A1-A2)

INVITED TALKS & LECTURES

University of the Chinese Academy of Sciences *(upcoming)*	Sep 2025
Max Planck Institute for Gravitational Physics Potsdam (ACR Seminar)	Sep 2025
Max Planck Institute for Gravitational Physics Hannover (Gravitational Wave Group Meeting)	Jun 2025
University of Mississippi (Department Colloquium)	Apr 2025
IHES, Paris-Saclay University (Amplitudes and Gravitation Seminar-IHES/IPhT)	Jan 2025
York University, Toronto (Department Colloquium)	Dec 2024
Institut d'astrophysique de Paris, Sorbonne University (GReCO seminar)	Jan 2024
IISER Pune (Physics Seminar)	Jan 2024
Paris Observatory, Paris Sciences et Lettres (PSL) University (LUTH Seminar)	Sep 2023
Missouri University of Science and Technology (Department Colloquium)	Aug 2023
Northwestern University	Jul 2023
University of Illinois Urbana-Champaign (lecture workshop; lecture notes here)	Jun 2022
Montana State University (Relativity, Astrophysics and Space Science Seminar)	Apr 2022
Max Planck Institute for Gravitational Physics Potsdam (ACR Seminar)	Jun 2021
Simon Fraser University (Cosmology Seminar)	Sep 2020

OUTREACH & SERVICE

- Contributor on Wikipedia including various articles on physics; see here and here
- Public talk in French (Journée du LUTH), Paris Observatory (2024)
- Public Talk on Astronomy - Univ. of MS (2023)
- Judge at The Speaker's Edge Competition 2022 - Univ. of MS
- Organized STEM Summer Camp - Univ. of MS (2018, 19)
- Organized Spooky Physics Night - Univ. of MS (2016, 17, 18)
- YouTube videos on research and popular science

PUBLICATIONS AND RESEARCH ARTICLES

1. T. Colin, **S. Tanay**, and L. Bernard. Solutions of spinning, eccentric binary black holes at 2^{nd} post-Newtonian order, *in prep.* 2024
2. T. Colin, **S. Tanay**, M. A. Morales, and L. Bernard. Orbit-averaged dynamics of spinning binary black holes in a Hamiltonian framework at 2^{nd} post-Newtonian order, *in prep.* 2024
3. V. Witzany, V. Skoupý, L. C. Stein, and **S. Tanay**. Actions of spinning compact binaries: Spinning particle in kerr matched to dynamics at 1.5 post-newtonian order. *Phys. Rev. D*, 111:044032, 2024, arXiv:2411.09742
4. **S. Tanay**. Towards a more robust algorithm for computing the Kerr quasinormal mode frequencies, 2022, arXiv:2210.03657 (to be submitted)
5. R. Samanta, **S. Tanay**, and L. C. Stein. Closed-form solutions of spinning, eccentric binary black holes at 1.5 post-Newtonian order. *Phys. Rev. D*, 108(14):124039, 2023, arXiv:2210.01605
6. **S. Tanay**. Integrability and action-angle-based solution of the post-Newtonian BBH system (lecture notes), 2022, arXiv:2206.05799
7. **S. Tanay**, G. Cho, and L. C. Stein. Action-angle variables of a binary black hole with arbitrary eccentricity, spins, and masses at 1.5 post-Newtonian order. *Phys. Rev. D*, 107(26):103040, 2021, arXiv:2110.15351
8. G. Cho, **S. Tanay**, A. Gopakumar, and H. M. Lee. Generalized quasi-Keplerian solution for eccentric, nonspinning compact binaries at 4PN order and the associated inspiral-merger-ringdown waveform. *Phys. Rev. D*, 105(6):064010, 2022, arXiv: 2110.09608
9. **S. Tanay**, L. C. Stein, and J. T. Gálvez Ghersi. Integrability of eccentric, spinning black hole binaries up to second post-Newtonian order. *Phys. Rev. D*, 103(6):064066, 2021, arXiv: 2012.06586
10. **S. Tanay**, A. Klein, E. Berti, and A. Nishizawa. Convergence of Fourier-domain templates for inspiraling eccentric compact binaries. *Phys. Rev. D*, 100(6):064006, 2019, arXiv:1905.08811
11. **S. Tanay**, M. Haney, and A. Gopakumar. Frequency and time domain inspiral templates for comparable mass compact binaries in eccentric orbits. *Phys. Rev. D*, 93(6):064031, 2016, arXiv:1602.03081