

# Sashwat Tanay

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[Google Scholar](#), [LinkedIn](#)

## EDUCATION

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<b>Ph.D. (Physics)</b> University of Mississippi	2016-2022
<b>Advisor:</b> Prof. Leo C. Stein	
<b>Dissertation:</b> Post-Newtonian Dynamics of Eccentric, Spinning Binary Black Holes and the Associated Gravitational Waveforms	
<b>B.Tech. (Mechanical Engineering)</b> Indian Institute of Technology Ropar	2009-2013

## EMPLOYMENT

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<b>Postdoctoral Fellow</b> LUTH, Paris Observatory - PSL University	2023-2025
<b>Adjunct Instructor</b> University of Mississippi	2022-2023
<b>Teaching and Research Assistant</b> University of Mississippi	2016-2022
<b>Junior Research Fellow</b> Tata Institute of Fundamental Research, Mumbai	2013-2015

## AWARDS & FELLOWSHIPS

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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

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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

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<b>Phys 211</b> Instructor of record (Adjunct Instructor, Univ. of Mississippi; <a href="#">course website here</a> ) <ul style="list-style-type: none"><li>• Developed and taught a calculus-based undergraduate physics course</li><li>• Created course material, delivered lectures and assessed student performance</li></ul>	Summer 2023
<b>Phys 221, 222, 223, 224</b> Undergrad physics lab courses (Teaching Assistant, Univ. of Mississippi) <ul style="list-style-type: none"><li>• Assisted in undergraduate physics lab courses</li><li>• Conducted lab sessions, and graded assignments</li></ul>	2016-2022

## MENTORING

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Supervision of 3 mentees have resulted in 3 research papers (one published and two in prep.), and that of a 4<sup>th</sup> 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

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

## PROFESSIONAL SERVICE

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

## INVITED TALKS & LECTURES

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Institut des Hautes Études Scientifiques (Amplitudes and Gravitation Seminar-IHES/IPhT) Jan 2025

York University, Toronto (Department Colloquium) Dec 2024

Institut d'astrophysique de Paris (GReCO seminar) Jan 2024

IISER Pune (Physics Seminar) Jan 2024

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, *remote*) Jun 2021

Simon Fraser University (Cosmology Seminar, *remote*) Sep 2020

## OUTREACH & SERVICE

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- 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](#)

## LANGUAGES

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

1. T. Colin, **S. Tanay**, and L. Bernard. Solutions of spinning, eccentric binary black holes at 2<sup>nd</sup> 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<sup>nd</sup> 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, 2024, [arXiv:2411.09742](#) (submitted)
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 Gherzi. 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](#)