

# Sashwat Tanay

[sashwat.tanay@obspm.fr](mailto:sashwat.tanay@obspm.fr)

Laboratoire Univers et Theories (LUTH), Paris Observatory  
5 place Jules Janssen, 92190 Meudon, France

[sashwattanay.github.io/site](https://sashwattanay.github.io/site)

ORCID: [0000-0002-2964-7102](https://orcid.org/0000-0002-2964-7102)

[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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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 9 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 systems • Extreme mass ratio inspirals (EMRIs)
- Found closed-form solutions to the trajectories of spinning BBHs at 1.5PN and 2PN order • Discovered two new constants of motion for these systems at 2PN order • Constructed orbital solutions of non-spinning BBHs at 4PN and the associated GWs • Performed data-analysis oriented studies on non-spinning BBHs in the context of detectability of GWs emanating from them • Improved the computation of QNM frequencies of spinning BHs • Computed the action-angle variables and the associated frequencies for spinning PN BBHs and EMRI systems within Hamiltonian mechanics.

## TEACHING EXPERIENCE

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<b>Phys 211</b> Instructor of record (Adjunct Instructor, Univ. of Mississippi; course website <a href="#">here</a> )	Summer 2023
<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 performance</li></ul>	
<b>Phys 221, 222, 223, 224</b> Undergrad physics lab courses (Teaching Assistant, Univ. of Mississippi)	2016-2022

- Assisted in undergraduate physics lab courses
- Conducted lab sessions, and graded assignments

## MENTORING

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Supervision of 2 mentees have resulted in two research papers each (published and in prep.), and that of another mentee into an undergrad thesis.

<b>Tom Colin</b> (postgrad, Ecole Normale Supérieure, Paris) led to Publication (1)	Oct 2023-present
<b>Manuel Alva</b> (undergrad, Universidad Nacional de Trujillo, Peru)	Nov 2023-present
<b>Rickmoy Samanta</b> (postdoc, ISI Kolkata) led to Publication (4)	Sep 2021-Sep 2022
<b>Pranav Kasetty</b> (undergrad thesis co-advisor, IISc Bengaluru)	Oct 2021-Apr 2022

## COMPUTER SKILLS

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- Mathematica (xAct), C/C++, Python, Fortran, Matlab, Jekyll (web development), Bash, Machine Learning (Scikit-learn) • [GitHub](#)

## PROFESSIONAL SERVICE

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<b>Referee</b> Physical Review & Physical Review Letters	Feb 2023-present
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## INVITED TALKS & LECTURES

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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
Univ. of Illinois Urbana-Champaign (lecture workshop; lecture notes <a href="#">here</a> )	Jun 2022
Montana State Univ. (Relativity, Astrophysics and Space Science Seminar)	Apr 2022
Max Planck Inst. for Gravitational Physics Potsdam (ACR Seminar, <i>remote</i> )	Jun 2021
Simon Fraser Univ. (Cosmology Seminar, <i>remote</i> )	Sep 2020

## OUTREACH & SERVICE

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- 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) • Public talk in French (Journée du LUTH), Paris Observatory (2024) • YouTube videos on [research](#) and [popular science](#)

## LANGUAGES

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Hindi, English, French (elementary)

## PUBLICATIONS AND RESEARCH ARTICLES

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1. T. Colin, **S. Tanay**, and L. Bernard. Revisiting 2PN Hamiltonian mechanics of binary black holes, *in prep.* 2024
2. V. Skoupý, L. C. Stein, **S. Tanay**, and V. Witzany. Actions of spinning compact binaries: Spinning particle in Kerr matched to dynamics at 1.5 post-Newtonian order, *in prep.* 2024

3. **S. Tanay**. Towards a more robust algorithm for computing the Kerr quasinormal mode frequencies, 2022, [arXiv:2210.03657](#) (to be submitted)
4. 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](#)
5. **S. Tanay**. Integrability and action-angle-based solution of the post-Newtonian BBH system (lecture notes), 2022, [arXiv:2206.05799](#)
6. **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](#)
7. 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](#)
8. **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](#)
9. **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](#)
10. **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](#)