

# Aliaksandra (Sasha) Levina

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## Research Interests

Gravitational wave astrophysics, black hole and neutron star merger rates and properties, binary and stellar evolution; I am interested in how gravitational waves can be used to study the properties of double compact objects and their progenitors in order to better understand stellar and binary evolution over cosmic history.

## Education

**Johns Hopkins University**, Baltimore, MD August 2023 - present  
**Ph.D.**, Astronomy (expected 2028)  
Advisors: Floor Broekgaarden, Emanuele Berti

**Haverford College**, Haverford, PA August 2019 - May 2023  
**B.S.**, Astronomy & Physics  
Concentration: Scientific Computing  
Senior thesis: “Applying Wind Roche-Lobe Overflow in Binary Evolution using MESA and POSYDON”

## Research

*Effect of the Star Formation History on the Binary Black Hole Merger Population*  
August 2023 - present  
Johns Hopkins University, Baltimore, MD  
Advisors: Floor Broekgaarden, Emanuele Berti, Lieke van Son

- Model the star formation rate density (SFRD) and cosmic chemical enrichment in the cosmological gravo-magnetohydrodynamic simulation IllustrisTNG using a parameterized model for the metallicity-dependent SFRD
- Optimize and validate the parametric model for the metallicity-dependent SFRD
- Test the effect of resolution and assumptions in six runs of the IllustrisTNG simulation on the metallicity-dependent SFRD and the binary black hole (BBH) merger population
- Investigate the impact of metallicity evolution over cosmic time on the merger rates and properties (e.g. primary mass distribution) of the BBH merger population using the rapid population synthesis code COMPAS

*Modeling Wind Roche-Lobe Overflow in Binary Evolution* June 2022 - May 2023  
Northwestern University, Evanston, IL  
CIERA REU  
Advisors: Vicky Kalogera, Meng Sun, Zoheyr Doctor

- Implemented a new physical mechanism for wind mass-transfer into the stellar evolution simulation code MESA (Modules for Experiments in Stellar Astrophysics) and the detailed binary population synthesis code POSYDON (Population SYnthesis with Detailed binary-evolution simuLatiONs)
- Simulated and analyzed binary system evolution using MESA
- Used the Quest High-Performance Computing Cluster to run population synthesis simulations using POSYDON
- The work culminated in a senior thesis (May 2023) and a paper published in ApJ in June 2024

*Analyzing Crab Pulsar X-ray Emission*  
Haverford College, Haverford, PA  
Advisor: Andrea Lommen

June 2020 - May 2023

- Developed code in Python and used a high-performance Linux computing cluster to analyze data and construct plots using observational data
- Developed a script that efficiently calculates pulse phases for pulsar timing data
- Contributed code to the NANOGrav pulsar timing analysis software PINT
- Used NICERSoft, HEASoft, and PINT to download and process data
- Used Bayesian statistics to fit models to observational data
- Utilized large quantities of pulsar timing data from NICER (Neutron star Interior Composition Explorer)

## Publications

Sun, M., **Levina, S.**, Gossage, S., Kalogera, V., Leiner, E. M., Geller, A. M., Doctor, Z., “Wind Roche-lobe Overflow in Low-mass Binaries: Exploring the Origin of Rapidly Rotating Blue Lurkers.” *ApJ* 969 8. DOI: 10.3847/1538-4357/ad47c1

Susobhanan, A., et al... **Levina, S.**..., “PINT: Maximum-likelihood Estimation of Pulsar Timing Noise Parameters.” *ApJ* 971 150. DOI: 10.3847/1538-4357/ad59f7

## Awards and Grants

William H. Miller III Graduate Fellowship 2023  
Johns Hopkins University  
Awarded to 10 PhD students per year

NSF Research Experiences for Undergraduates 2022  
Northwestern CIERA REU

Marian E. Koshland Integrated Natural Sciences Center Summer Scholars 2020  
Haverford College

## Talks and Poster Presentations

“The effect from uncertainties in cosmological simulations on the binary black hole merger population”

- Lorentz Center workshop: Gravitational waves: a new ear on the chemistry of galaxies, Leiden, the Netherlands. April 2024
- Nordic Winter School on Multimessenger Astrophysics, Skeikampen, Norway. January 2024

“Applying wind Roche-lobe overflow in binary evolution using MESA and POSYDON”

- Senior thesis poster session, Haverford College, May 2023
- 241st Meeting of the American Astronomical Society, January 2023
- Summer research symposium, Haverford College, September 2022
- CIERA REU poster session, Northwestern University, August 2022

“Pulse-to-pulse intensity modulation of the Crab Pulsar using NICER”

- NANOGrav 2022 Fall Meeting poster session, University of Wisconsin-Milwaukee, October 2022

“Pulse-to-pulse intensity modulation of three X-ray pulsars using NICER data”

- NANOGrav 2021 Fall Meeting poster session, Vanderbilt University, October 2021
- Summer research symposium, Haverford College, September 2021
- 237th Meeting of the American Astronomical Society, January 2021

- NANOGrav 2020 Fall Meeting, October 2020
- Summer research symposium, Haverford College, September 2020

## Workshops

Code/Astro, CIERA, July 2024  
 Workshop on software development and writing effective open-access code

3rd MaNiTou Summer School on Gravitational Waves, July 2024

Gravitational waves: a new ear on the chemistry of galaxies, Lorentz Center, April 2024

Stable mass transfer in binaries: from onset to remnant, Center for Computational Astrophysics, March 2024

Nordic Winter School on Multimessenger Astrophysics, January 2024

## Conferences

Gender Minorities & Women in Physics Summit, September 2023

241st Meeting of the American Astronomical Society, January 2023

NANOGrav 2022 Fall Meeting, October 2022

237th Meeting of the American Astronomical Society, January 2021

NANOGrav 2021 Fall Meeting, October 2021

NANOGrav 2020 Fall Meeting, October 2020

## Teaching

Teaching Assistant:

- General Physics I for Biological Science Majors, Fall 2024
- General Physics Laboratory I, Fall 2024

## Outreach

“Physics and astronomy research talks” and “Careers in STEM” Q&A panel at City Neighbors High School, December 2023

## Skills

- Programming Languages: Python, Fortran, MatLab, HTML, CSS
- Operating systems: Mac OS, Windows OS, Linux
- Software: LaTeX, Git, Mathematica
- Other: High-Performance Computing Clusters

## Professional Memberships

American Astronomical Society  
 American Physical Society  
 Society of Physics Students and Sigma Pi Sigma Physics Honor Society