

# Shuo Xin

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## EDUCATION

**School of Physics Science and Engineering | Tongji University | China**

Sept. 2016 - Present

B.S. in Applied Physics (Jul 2020)

GPA: 4.84/5.0, Ranking: 1/75

**Department of Physics | University of Rome (La Sapienza) | Italy**

Feb. 2018 - July 2018

Erasmus+ Scholarship for undergraduate exchange students

**School of Physics and Cosmology | Tokyo Institute of Technology | Japan**

Apr. 2019 - Jun. 2019

ACAP Research Exchange: Studying 3+1 formalism of numerical relativity

**LIGO | California Institute of Technology | U.S.**

Jun. 2019 - Aug. 2019

Summer Undergraduate Research Fellowship

## PUBLICATIONS & PREPRINTS

- **Shuo Xin**, Wen-Biao Han, and Shucheng Yang, Gravitational waves from extreme mass ratio inspirals using general parametrized metrics, *Phys. Rev. D*, 100:084055 (2019) [[arXiv:1812.04185](https://arxiv.org/abs/1812.04185)]
- Jason Dexter, **Shuo Xin**, et al., The Sloan Digital Sky Survey Reverberation Mapping Project: Accretion and Broad Emission Line Physics from a Hypervariable Quasar, *Ap. J.* 885(1):44 (2019) [[arXiv:1906.10138](https://arxiv.org/abs/1906.10138)]
- Sourabh Nampalliwar, **Shuo Xin**, et al. Testing General Relativity with X-ray reflection spectroscopy: The Konoplya-Rezzolla-Zhidenko parametrization, submitted to *Phys. Rev. D* [[arXiv:1903.12119](https://arxiv.org/abs/1903.12119)]
- Shu-Cheng Yang, Wen-Biao Han, **Shuo Xin**, and Chen Zhang, Testing dispersion of gravitational waves from eccentric sources, *Int. J. Mod. Phys. D* 1950166 (2019) [[arXiv:1812.04350](https://arxiv.org/abs/1812.04350)]
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## RESEARCH EXPERIENCES

**Constructing gravitational wave (GW) echo waveforms from spinning ECO | SURF fellow**

Jun. 2019 - Present

Advisor: Yanbei Chen, Professor, California Institute of Technology

- **Mathematics:** Derived necessary formulae for echo solution to Teukolsky equation in black hole perturbation theory
- **Coding:** Modified Fortran code solving Teukolsky equation to incorporate echo solution and made templates
- Compared “ingoing” waveforms via Teukolsky equation and Zerilli equation near horizon, a missing piece in literature

**Spin angular momentum and Berry phase of GWs | Research Assistant**

Mar. 2019 - Present

Advisor: Jie Ren, Professor, Tongji University

- **Mathematics:** Described spin angular momentum (SAM) carried by GWs in Dirac notation. Derived Berry curvature and Chern number of gravitational plane waves. Separated the vector and scalar potentials in Teukolsky equation.
- **Coding:** Computed geometric phases of GWs following twisted trajectories.
- Gave a new viewpoint for GW SAM tensor. Predicted geometric phase of GW. A first-authored paper is in preparation

**GWs from EMRIs using general parametrized metrics | Research Assistant**

Aug. 2018 - Mar. 2019

Advisor: Wenbiao Han, Professor, Shanghai Astronomical Observatory

- **Coding:** Calculated waveforms from extreme-mass-ratio inspirals (EMRIs) by “Numerical Kludge” method using C++
- **Data analysis:** Studied degeneracies between Kerr and non-Kerr waveforms in matched filtering processes
- **Developed software package:** <https://github.com/XinShuo-ph/XSPEG> (registered in Chinese Software Copyright)
- **Led to a first-authored paper published on *Phys. Rev. D* and contributed to a third-authored paper**

**Analyzing “changing-look” quasars | Research Assistant**

Aug. 2018 - Mar. 2019

Advisor: Jason Dexter, Junior Research Group Leader, Max-Planck Institute for Extraterrestrial Physics

- **Data Analysis:** Analyzed spectroscopic and photometric data of the hypervariable quasar SDSS J131424+530527
- **Contributed to a second-authored paper published on *Astrophysical Journal***

**Modeling and data analysis of relativistic iron line** | Research Assistant

Oct. 2017 - Jul. 2018

Advisor: Cosimo Bambi, Professor, Fudan University

- **Coding:** Extended a non-Kerr relativistic X-ray model in XSPEC to KRZ metric
- **Data analysis:** Executed data reduction and analysis based on XSPEC for simulated observation
- **Contributed to a second-authored paper submitted to *Phys. Rev. D***

**Establishing photoelectric response mapping system** | Research Assistant

Mar. 2017 - Dec. 2017

Advisor: Faxian Xiu, Professor, Fudan University

- **Technical work:** Assembled current meters, microscopes, piezo flexure stages and others into a system suitable for measuring photoelectric responses of 2D materials
- **Coding:** Wrote LabVIEW programs to coordinate different instruments and control the mapping process

**AWARDS**

- National Scholarship of China (in 3<sup>rd</sup> academic year) (top 1/75) Oct. 2019
- National Scholarship of China (in 2<sup>nd</sup> academic year) (top 1/77) Oct. 2018
- First Prize of Tongji Scholarship of Excellence (top 1/32) Oct. 2017
- Scientific Youth Scholarship in School of Physics (top 5/300+) Oct. 2017
- First Prize in National Physics Competition for College Students (Shanghai division) (top 1%) Dec. 2016

**ACADEMIC ACTIVITIES****Contributed talks:**

- Oral presentation: **Constructing echo waveforms from spinning ECOs** 14<sup>th</sup> Oct. 2019 - 17<sup>th</sup> Oct. 2019  
on [Gravitational Wave Physics and Astronomy Workshop](#), Tokyo University, Tokyo, Japan
- Poster presentation: **EMRIs in general parametrized metric** 7<sup>th</sup> Oct. 2019 - 11<sup>th</sup> Oct. 2019  
on [YKIS2019: Black Holes and Neutron Stars with Gravitational Waves](#), Kyoto University, Kyoto, Japan
- Oral presentation: **Study of Extreme-Mass-Ratio Inspirals in non-Kerr spacetime** 29<sup>th</sup> Dec. 2018  
on Shanghai Innovational Forum for Graduate Students, Tongji University, Shanghai, China

**Schools and others:**

- **Gravitational Wave Data Analysis Winter School** | CAS | Beijing, China 25<sup>th</sup> Feb. 2019 - 8<sup>th</sup> Mar. 2019
- **STEP Youth Technology and Society Forum** | NUS | Singapore 7<sup>th</sup> Jan. 2019 - 13<sup>th</sup> Jan. 2019
- **HASCO Hadron Collider Summer School** | University of Göttingen | Germany 20<sup>th</sup> Jul. 2018 - 28<sup>th</sup> Jul. 2018
- Membership: **KAGRA collaboration** (affiliated with Shanghai Astronomical Observatory) May. 2019 - present

**SKILLS & OTHERS**

Programming Languages: C/C++, Python, Fortran, Mathematica, LabVIEW, MATLAB, bash (Linux)

GRE general: Verbal - 167/170 (98 percentile), Quantitative - 170/170 (96 percentile), Analytical Writing - 3.5

GRE Physics: 990/990 (95 percentile)

TOEFL: Total 112 (Reading 30, Listening 30, Speaking 24, Writing 28)

**Core courses at University of Rome (La Sapienza):**

- |                                               |              |                  |                        |
|-----------------------------------------------|--------------|------------------|------------------------|
| ➤ <i>Mathematical Physics,</i>                | Master level | Credits: 6 ECTS  | Grade: 30/30 cum laude |
| ➤ <i>Computational Statistical Mechanics,</i> | Master level | Credits: 6 ECTS  | Grade: 30/30 cum laude |
| ➤ <i>Solid State Physics,</i>                 | Master level | Credits: 6 ECTS  | Grade: 30/30           |
| ➤ <i>Particle Physics,</i>                    | Master level | Credits: 12 ECTS | Grade: 30/30           |
| ➤ <i>Theoretical Astrophysics,</i>            | Master level | Credits: 6 ECTS  | Grade: 27/30           |

**Core courses at Tokyo Institute of Technology:**

- |                                       |              |            |               |
|---------------------------------------|--------------|------------|---------------|
| ➤ <i>Cosmology,</i>                   | Master level | Credits: 2 | Grade: 95/100 |
| ➤ <i>Applied Functional Analysis,</i> | Master level | Credits: 2 | Grade: 90/100 |
| ➤ <i>Basic Nuclear Physics,</i>       | Master level | Credits: 2 | Grade: 93/100 |