Minghao Guo

Personal Information

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Education

Peking University — Beijing, CN

Bachelor of Science, Physics, Minor in Mathematics — Sept 2016 – Present

- GPA: 3.65/4.0; GRE Physics 990/990

Research Interests

- Galaxy dynamics and evolution, galaxy structure
- Black hole, high energy astrophysics, accretion disks, SMBHs.
- Modified gravity, neutron stars, pulsars, gravitational waves, dark matter.
- Numerical simulations, Numerical methods, New numerical techniques.

Publications

1. Minghao Guo, Kohei Inayoshi, Tomonari Michiyama, and Luis C. Ho, Hunting for Wandering Massive Black Holes, ApJ **901**, 39 (2020), arXiv:2006.08203 [astro-ph.HE] .
2. Minghao Guo, Min Du, Luis C. Ho, Victor P. Debattista, and Dongyao Zhao, A New Channel of Bulge Formation via the Destruction of Short Bars, ApJ **888**, 65 (2020), arXiv:1911.07002 [astro-ph.GA] .
3. Minghao Guo, Lijing Shao, and Junjie Zhao, Extended reduced-order surrogate models for scalar-tensor gravity in the strong field and applications to binary pulsars, in preparation (2020).

References

Director, Prof. Luis C. Ho — Kavli Institute for Astronomy and Astrophysics, Peking University
lho.pku@gmail.com

Prof. Victor P. Debattista — University of Central Lancashire
vpdebattista@gmail.com

Prof. Kohei Inayoshi — Kavli Institute for Astronomy and Astrophysics, Peking University
inayoshi0328@gmail.com

Prof. Lijing Shao — Kavli Institute for Astronomy and Astrophysics, Peking University
lshao@pku.edu.cn

Research Experience

Numerical study of scalar-tensor gravity and application to pulsars — Feb 2020 – Present

Advisor: Lijing Shao — Peking University, CN

- Designed and developed a method for computing derived quantities in scalar-tensor gravity of Damour and Esposito-Farèse (DEF) with pontaneous scalarization phenomena developed for neutron stars.
- Constructed reduced-order surrogate model for the derived quantities.
- Integrated the model into a python package pySTGROMX that speeds up calculations at two order-of-magnitude yet still keeps accuracy, compared with the previous method.
- Applied pySTGROMX to constrain the parameters of the DEF theory with well-timed binary pulsars
- Currently working on a first-author paper manuscript in prep for Physical Review D.

Hunting for wandering massive black holes Feb 2019 – Present

Advisor: Kohei Inayoshi, Luis C. Ho Peking University, CN

- Performed three-dimensional simulations for gas accretion onto a wandering black hole at the outskirts of galaxies (e.g., massive ellipticals, Milky Way, dwarf galaxies).
- Constructed radiative inefficient accretion-flow models for accretion near the horizon of a black hole.
- Applied the simulation results to the emission model and calculated the spectral energy distribution for the accretion flow onto a wandering black hole.
- Studied the detectability of wandering (super-massive) black holes in different types of galaxies, predicting that ALMA will enable us to hunt for a population of wandering BHs.
- Published a paper in the Astrophysical Journal as the first-author.

Quasar lifetime model June 2020 – Sept 2020

Advisor: Kohei Inayoshi Peking University, CN

- Constructed a model for lifetime of quasars.
- Built a theoretical correlation between the mass, luminosity and lifetime of quasars.
- Compared the model with the observed quasar lifetimes from measurements of proximity zone size.

Co-evolution between black holes and their host galaxies Mar 2018 - Jan 2020

Advisor: Luis C. Ho,Victor P. Debattista Peking University, CN

- Made N-body simulations to investigate the dissolution of bars and the growth of bulges, under the dynamical influence of central black holes
- Built morphological decomposition for the structures of the galaxy models using IRAF and GALFIT.
- Investigated the growth of a central black hole, the dissolution of the nuclear bar, and the gradual formation of an inner bulge through morphological decomposition as well as the dynamics of galaxies.
- Demonstrated that the initially boxy/peanut-shaped bulge is transformed into a more massive, compact structure that bears many similarities to a classical bulge, in terms of its morphology, kinematics, and location on standard scaling relations (Kormendy relation, mass-size relation, and correlations between black hole mass and bulge stellar mass and velocity dispersion).
- Led to a first-author paper published in Astrophysical Journal.

Honors and Awards

Lin-bridge First Prize for Undergraduate Research (endowed by Prof. Douglas Lin)	Sept 2020
Yuanpei College First Award for Undergraduate Research	June 2020
Xingcheng Award for Undergraduate Research	May 2019
National Undergraduate Research & Training Program	May 2019
Peking University Scholarship for Outstanding Freshmen	Sept 2016

Conference Experience

PKU Undergraduate Astronomy Symposium Sept 2020

(Oral presentation) *Hunting for Wandering Massive Black Holes*

2019 Annual Meeting of Chinese Astronomical Society Sept 2019

(Oral presentation) *A New Channel of Bulge Formation via the Destruction of Short Bars*

IAU Symposium 353: Galactic Dynamics in the Era of Large Surveys June 2019

(Poster presentation) *A New Channel of Bulge Formation via the Destruction of Short Bars*

Activities

- 2020 Theoretical Physics and Particle Physics Summer School of Peking Unversity Aug 2020
- São Paulo School of Advanced Science on First Light:
  Stars, Galaxies and Black Holes in the Epoch of Reionization Aug 2019

Technical Skills

Programming: Proficient in Python, C/C++, LaTeX, and Mathematica. Basic knowledge of Matlab, Fortran.
Software ans Packages: emcee, Git, MPI, OMP, cuda, SymPy, yt, VisIt, ParaView, PLUTO, IRAF, GALFIT
Experience: Massive parallel computing on supercomputer, analyzing dataset and visualization.
Language: Mandarin (Native), English (Fluent, GRE General 320+3, TOEFL iBT 102)