Minghao Guo

Personal Information

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Homepage:	AstroMG.github.io	GitHub:	github.com/AstroMG

Education

Peking University   Beijing, CN

Undergraduate of Science, Physics, Minor in Mathematics   Sept 2016 – Present

- GPA: 3.64/4.0; 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, 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).

2. 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] .

3. 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] .

References

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
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Prof. Lijing Shao   Kavli Institute for Astronomy and Astrophysics, Peking University
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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.

Accretion of black hole   Feb 2019 – Present
Advisor: Kohei Inayoshi, Luis C. Ho   Peking University, CN
- Performed three-dimensional simulations for asymmetric accretion onto wandering black hole at outskirts of galaxies to investigate the properties of accretion flow.
- Constructed radiative inefficient accretion flow model for accretion near the horizon of black hole.
- Applied the simulation results onto the model and calculated the radiation spectral energy distribution for accretion flow onto wandering black holes.
- 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.
- Led to a first-author paper published in Astrophysical Journal.

Quasar lifetime model   June 2020 – Sept 2020
Advisor: Kohei Inayoshi   Peking University, CN
- Constructed model for 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 (CNY 2,000, endowed by Prof. Douglas Lin)	Sept 2020
Yuanpei College First Award for Undergraduate Research (CNY 8,000)	June 2020
National Undergraduate Research & Training Program (CNY 10,000)	May 2019
Peking University Scholarship for Outstanding Freshmen(CNY 25,000)	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)