

Yueying Ni

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EDUCATION

Carnegie Mellon University

Ph.D. in Physics

Pittsburgh, PA

Sep. 2017 – present

Fudan University

B.S. in Physics

Shanghai, China

Sep. 2013 – June 2017

RESEARCH INTERESTS

High- z galaxies and quasars: cosmological hydrodynamic simulations, constrained Gaussian realizations, large-scale structures, growth of the first quasars, galaxy formation, AGN feedback, the dynamics of super massive black holes (SMBH)

Deep Learning: generative model, super-resolution simulations

Alternative dark matter: astrophysical probes of Fuzzy Dark Matter (FDM) model

HIGHLIGHT WORKS

Asterix Simulation

- Developing a new large-volume cosmological hydrodynamic simulation (on TACC Frontera Supercomputer) to study the epoch of re-ionization as well as the formation of galaxy and SMBHs at $z > 2$.

Super-resolution simulation

- Use super resolution generative models to generate high-resolution realizations of the dark matter field from the low-resolution cosmological simulation. Currently working on applying the model to hydro simulations.

BlueTides Simulation

- Carry out BlueTides simulation (the largest ever cosmological hydrodynamic simulation) down to $z = 6.5$ with the full capacity of BlueWater Supercomputer, to study the $z > 6$ quasars in cosmological volume.

Early quasar growth in Constrained Realizations

- Develop the first open-source code *GaussianCR* for the implementation of the constrained realization technique on Gaussian random field, to probe the relation between the initial density peaks and the growth of the early quasars.

PUBLICATIONS

First Author Papers

- Y. Ni**, Y. Li, P. Lachance, R. A. C. Croft, T. Di Matteo, S. Bird et al., *AI-assisted superresolution cosmological simulations - II. Halo substructures, velocities, and higher order statistics*, *MNRAS* **507** (2021) 1021 [2105.01016]
- Y. Ni**, T. Di Matteo and Y. Feng, *Not all peaks are created equal: the early growth of Supermassive Black Holes*, *arXiv e-prints* (2020) arXiv:2012.04714 [2012.04714]
- Y. Ni**, T. Di Matteo, R. Gilli, R. A. C. Croft, Y. Feng and C. Norman, *QSO obscuration at high redshift ($z \gtrsim 7$): predictions from the BLUETIDES simulation*, *MNRAS* **495** (2020) 2135 [1912.03780]
- Y. Ni**, M.-Y. Wang, Y. Feng and T. Di Matteo, *Predictions for the abundance of high-redshift galaxies in a fuzzy dark matter universe*, *MNRAS* **488** (2019) 5551 [1904.01604]
- Y. Ni**, T. Di Matteo, Y. Feng, R. A. C. Croft and A. Tenneti, *Gas outflows from the $z = 7.54$ quasar: predictions from the BLUETIDES simulation*, *MNRAS* **481** (2018) 4877 [1806.00184]
- Y. Ni**, J. Jiang and C. Bambi, *Testing the Kerr metric with the iron line and the KRZ parametrization*, *J. Cosmology Astropart. Phys.* **2016** (2016) 014 [1607.04893]
- Y. Ni**, M. Zhou, A. Cárdenas-Avendaño, C. Bambi, C. A. R. Herdeiro and E. Radu, *Iron $K\alpha$ line of Kerr black holes with scalar hair*, *J. Cosmology Astropart. Phys.* **2016** (2016) 049 [1606.04654]

Second Author Papers

- N. Chen, **Y. Ni**, M. Tremmel, T. Di Matteo, S. Bird, C. DeGraf et al., *Dynamical Friction Modeling of Massive Black Holes in Cosmological Simulations and Effects on Merger Rate Predictions*, *arXiv e-prints* (2021) arXiv:2104.00021 [2104.00021]
- Y. Li, **Y. Ni**, R. A. C. Croft, T. Di Matteo, S. Bird and Y. Feng, *AI-assisted super-resolution cosmological simulations*, *arXiv e-prints* (2020) arXiv:2010.06608 [2010.06608]
- M. A. Marshall, **Y. Ni**, T. Di Matteo, J. S. B. Wyithe, S. Wilkins, R. A. C. Croft et al., *The host galaxies of $z = 7$ quasars: predictions from the BLUETIDES simulation*, *MNRAS* **499** (2020) 3819 [1912.03428]
- K.-W. Huang, **Y. Ni**, Y. Feng and T. Di Matteo, *The early growth of supermassive black holes in cosmological hydrodynamic simulations with constrained Gaussian realizations*, *MNRAS* **496** (2020) 1 [1906.00242]

Other co-author Papers

- M. A. Marshall, J. S. B. Wyithe, R. A. Windhorst, T. Di Matteo, **Y. Ni**, S. Wilkins et al., *Observing the host galaxies of high-redshift quasars with JWST: predictions from the BlueTides simulation*, *arXiv e-prints* (2021) arXiv:2101.01219 [2101.01219]
- K. Ren, M. Trenti, M. A. Marshall, T. Di Matteo and **Y. Ni**, *The Diversity of Environments around Luminous Quasars at Redshift z 6*, *ApJ* **917** (2021) 89 [2106.07027]

TALKS

BlueWater Symposium <i>Talk: BlueTides simulation: first galaxies and QSOs at the cosmic dawn</i>	June 2019 Sunriver, OR
Big eye in the early universe <i>Talk: High-z quasar outflows and obscuration</i>	January 2019 UCLA, CA
Camels Project Meeting <i>Talk: Super resolution simulations</i>	Jan 2021 virtual, Flatiron Institute, CCA, NY
Cosmology group meeting <i>Talk: Super resolution simulations</i>	Nov 2020 virtual, Harvard-CfA, MA
NSF AI Institute seminar <i>Talk: Super resolution simulations</i>	March 2021 virtual, CMU
Kavli IPMU seminar <i>Talk: Super resolution simulations</i>	May 2021 virtual, IPMU
Machine learning in Astrophysics seminar <i>Talk: Super resolution simulations</i>	May 2021 virtual, Tsinghua University
LISA Astrophysics Working Group Meeting <i>Talk: Massive BH binaries and their EM counterparts in the Asterix simulation</i>	June 2021 virtual, LISA collaboration
Cosmos'21 Conference <i>Talk: Super resolution simulations</i>	August 2021 virtual, University of Illinois

AWARD

McWilliams Fellowship <i>Carnegie Mellon University</i>	Sep. 2021 - May. 2022
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STUDENT SUPERVISION

Kerry Jappe (BCs, CMU) <i>Cosmological simulation of the fuzzy dark matter</i>	Oct. 2019 - Apr. 2020
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SERVICE

Simulation data portal: BlueTides database (<http://bluetides.psc.edu>)

A project with Pittsburgh Supercomputing Center. Build the public available database that provides access and API for BlueTides simulation.

Code publicly available: GaussianCR (<https://github.com/yueyingn/gaussianCR>)

A python module that impose constraints on Gaussian primordial density field and generate initial condition for cosmological simulations.

TEACHINGS

- 33-141 Physics I for Engineering Students, *Spring 2019*
- 33-104 Experimental Physics, *Fall 2018*
- 33-152 Matter and Interaction II, *Spring 2018*
- 33-121 Physics I for Science Students, *Fall 2017*

PRESS RELEASES

Evolving the early universe in 24 hours on Frontera, featured in TACC Press Releases (url: <https://www.tacc.utexas.edu/-/evolving-the-early-universe-in-24-hours-on-frontera>).

Simulations Show Webb Telescope Can Reveal Distant Galaxies Hidden in Quasars' Glare, featured in NASA's James Webb Space Telescope Science Release (url: <https://webbtelescope.org/contents/news-releases/2020/news-2020-51>).

Machine learning accelerates cosmological simulations featured in Phys Org Release (url: <https://phys.org/news/2021-05-machine-cosmological-simulations.html>).

New Application of Artificial Intelligence Just Removed One of the Biggest Roadblocks in Astrophysics featured in Simons Foundation Press Release (url: <https://www.simonsfoundation.org/2021/05/04/new-application-of-artificial-intelligence-just-removed-one-of-the-biggest-roadblocks-in-astrophysics/>).

Machine Learning Accelerates Cosmological Simulations featured in MCS CMU news (url: https://www.cmu.edu/physics/news-events/news-archive/2021/0505_supersims.html).

SKILLS AND LANGUAGES

Programming: Python, C/C++, PyTorch, bash

Simulation codes: MP-Gadget, FastPM

Languages: Mandarin (native), English (fluent)