

# Yueying Ni

[yueyingn@andrew.cmu.edu](mailto:yueyingn@andrew.cmu.edu) | <https://yueyingn.github.io>

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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*

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## RESEARCH INTERESTS

**High- $z$  galaxies and quasars:** cosmological hydrodynamic simulations, constrained Gaussian realizations, growth of early quasars, galaxy evolution, AGN feedback, the dynamics of SMBH

**Deep Learning:** generative model, super-resolution simulations

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

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## WORKS IN PROGRESS

### Asterix Simulation

- Launching 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 quasars at  $z > 2$ . Asterix will also provide us a training suite of cosmological hydrodynamic simulation for machine learning models.

### Super resolution simulation

- Use super resolution generative models to generate high-resolution realizations conditioned on low-resolution simulation outputs. Currently working on applying the model to hydro simulations.

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## HIGHLIGHT WORK

### BlueTides Simulation

- Run BlueTides simulation (the largest ever cosmological hydrodynamic simulation) down to  $z = 6.5$  with the full capacity of BlueWater Supercomputer, using 4M node-hours of computer allocation.

### Early quasar growth

- Develop publicly available code *GaussianCR* to implement the constrained realization technique on Gaussian random field.
- Probe the relation between the initial density peaks and the growth of super massive black holes in cosmological simulations.

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## PUBLICATIONS

### First Author Papers

- 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

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](#)]

## TALKS

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<b>BlueWater Symposium</b>	June 2019
<i>Talk: BlueTides simulation: first galaxies and QSOs at the cosmic dawn</i>	<i>Sunriver, OR</i>

<b>Big eye in the early universe</b>	January 2019
<i>Talk: High-<math>z</math> quasar outflows and obscuration</i>	<i>UCLA, CA</i>

<b>Camels Project Meeting</b>	Jan 2021
<i>Talk: Super resolution simulations</i>	<i>virtual, Flatiron Institute, CCA, NY</i>

<b>Blackhole joint group meeting</b>	Oct 2020
<i>Talk: Impact of large scale structures on the growth of early QSOs</i>	<i>virtual, CMU, PA</i>

<b>Cosmology group meeting</b>	Nov 2020
<i>Talk: Super resolution simulations</i>	<i>virtual, Harvard-CfA, MA</i>

## STUDENT SUPERVISION

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

## SERVICE

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**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

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- 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

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*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>).

## SKILLS AND LANGUAGES

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

**Simulation codes:** MP-Gadget, FastPM

**Languages:** Mandarin (native), English