

EVAN J. ARENA

Ph.D. Candidate ◊ Department of Physics ◊ Drexel University
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RESEARCH INTERESTS

Theoretical astrophysics and cosmology, including general relativity, gravitational lensing, modified gravity, large-scale structure, 21 cm cosmology, dark energy, inflation, dark matter, radio astronomy, and gravitational waves.

EDUCATION

Drexel University

Ph.D. Student/Candidate of Physics

2018 – Present

M.S. in Physics

2020

GPA: 3.95

Stony Brook University

B.S. in Physics, second major: Astronomy/Planetary Sciences

2017

GPA: 3.55 (*Cum Laude*)

Departmental Honors in Physics

POSITIONS HELD

Drexel University

2018 – Present

Doctoral Teaching Fellow and CoAS Dean's Fellow

Department of Physics

Stony Brook University and Brookhaven National Laboratory

2015 – 2019

Research Assistant

SBU Department of Physics & Astronomy and BNL Department of Physics

Brookhaven National Laboratory

2012 – 2013

Intern

Department of Physics

AWARDS AND HONORS

Graduate College Continuing Excellence in Teaching Assistance Award, Drexel University

2022

Graduate College Continuing Excellence in Teaching Assistance Award, Drexel University

2021

Graduate College Teaching Assistant Excellence Award, Drexel University

2020

Sigma Xi Scientific Research Honor Society Member, Drexel University

2019

College of Arts and Sciences (CoAS) Dean's Fellowship, Drexel University

2018

Sigma Pi Sigma National Physics Honor Society Member, Stony Brook University

2017

Presidential Scholarship, Stony Brook University

2013

RESEARCH HISTORY

2018 – Present

Weak gravitational lensing

Developed a novel method for measuring the second-order weak gravitational lensing effect known as flexion. Created a full theoretical formalism for “cosmic flexion” – a family of cosmological weak lensing signals originating from the large-scale structure of the universe. Discovered previously unknown cosmological weak lensing signals and posited the existence of non-commutativity in weak lensing.

- 2015 – 2019 **Low redshift 21 cm intensity mapping**
Cosmological parameter and modified gravity forecasts for a general 21 cm cosmology experiment, member of the DOE Cosmic Visions Dark Energy 21 cm Working Group, and design and construction of the radio telescope used for the 21 cm Baryon Mapping eXperiment at Brookhaven National Laboratory.
- 2013 **Gravitational waves**
New method for the indirect detection of gravitational waves.
- 2012 **Modified Newtonian Dynamics**
Investigated the plausibility of Modified Newtonian Dynamics on a local scale based on rotation curves of the Milky Way.

REFEREED PUBLICATIONS

3. **Arena, E. J.**, “*Weak gravitational flexion in various spacetimes: Exotic lenses and modified gravity*,” Submitted to Phys.Rev.D (2022) [[arXiv:2207.07784](#)]
2. **Arena, E. J.**, Goldberg, D. M., and Bacon, D. J., “*Cosmic flexion*,” Phys.Rev.D **105**, 123521 (2022) [[arXiv:2203.12036](#)]
1. Fabritius, J. M., **Arena, E. J.**, and Goldberg, D. M. “*Shape, color, and distance in weak gravitational flexion*,” Mon.Not.Roy.Astron.Soc. **501**, 4103 (2021) [[arXiv:2006.03506](#)]

CONFERENCE PROCEEDINGS, SCIENCE BOOKS, WHITE PAPERS

3. Ahmed, Z., Alonso, D., Amin, M. A., Ansari, R., **Arena, E. J.**, Bandura, K., Beardsley, A., Bull, P., Castorina, E., Chang, T.-C., Davé, R., Dillon, J. S., van Engelen, A., Ewall-Wice, A., Ferraro, S., Foreman, S., Frisch, J., Green, D., Holder, G., Jacobs, D., Karagiannis, D., Kaurov, A. A., Knox, L., Kuhn, E., Liu, A., Ma, Y.-Z., Masui, K. W., McClintock, T., Moodley, K., Münchmeyer, M., Newburgh, L. B., Nomerotski, A., O’Connor, P., Obuljen, A., Padmanabhan, H., Parkinson, D., Perdureau, O., Rapetti, D., Saliwanchik, B., Sehgal, N., Shaw, J. R., Sheehy, C., Sheldon, E., Shirley, R., Silverstein, E., Slatyer, T., Slosar, A., Stankus, P., Stebbins, A., Timbie, P., Tucker, G. S., Tyndall, W., Villaescusa-Navarro, F., and Wulf, D., “*Research and Development for HI Intensity Mapping*,” ArXiv e-prints (2019) [[arXiv:1907.13090](#)]
2. Ahmed, Z., Alonso, D., Amin, M. A., Ansari, R., **Arena, E. J.**, Bandura, K., Battaglia, N., Blazek, J., Bull, P., Castorina, E., Chang, T.-C., Connor, L., Davé, R., Dillon, J. S., Dvorkin, C., van Engelen, A., Ferraro, S., Flauger, R., Foreman, S., Frisch, J., Green, D., Holder, G., Jacobs, D., Johnson, M. C., Karagiannis, D., Kaurov, A. A., Knox, L., Liu, A., Loverde, M., Ma, Y.-Z., Masui, K. W., McClintock, T., Meerburg, P. D., Moodley, K., Münchmeyer, M., Newburgh, L. B., Ng, C., Nomerotski, A., O’Connor, P., Obuljen, A., Padmanabhan, H., Parkinson, D., Prochaska, J. X., Rajendran, S., Rapetti, D., Saliwanchik, B., Schaan, E., Sehgal, N., Shaw, J. R., Sheehy, C., Sheldon, E., Shirley, R., Silverstein, E., Slatyer, T., Slosar, A., Stankus, P., Stebbins, A., Timbie, P., Tucker, G. S., Tyndall, W., Villaescusa-Navarro, F., Wallisch, B., and White, M., “*Packed Ultra-wideband Mapping Array (PUMA): A Radio Telescope for Cosmology and Transients*,” Bull.Am.Astron.Soc. **51**, 53 (2019) [[arXiv:1907.12559](#)]
1. Cosmic Visions 21 cm Collaboration, Ansari, R., **Arena, E. J.**, Bandura, K., Bull, P., Castorina, E., Chang, T.-C., Foreman, S., Frisch, J., Green, D., Karagiannis, D., Liu, A., Masui, K. W., Meerburg, P. D., Newburgh, L. B., Obuljen, A., O’Connor, P., Shaw, J. R., Sheehy, C., Slosar, A., Smith, K., Stankus, P., Stebbins, A., Timbie, P., Villaescusa-Navarro, F., and White, M., “*Inflation and Early Dark Energy with a Stage II Hydrogen Intensity Mapping experiment*,” ArXiv e-prints (2018) [[arXiv:1810.09572](#)]

CONFERENCES AND TALKS

Contributed Talks

- “Weak gravitational flexion in the Dark Energy Survey”
Talk to DES Weak Lensing Working Group, Virtual meeting 11 May 2022
- “Hybrid analytic image modeling and image moments approach to gravitational lensing”
Public talk for my Physics Ph.D. Candidacy Exam, Drexel University 4 Jun. 2020
- Research talk to incoming graduate students, Drexel University 17 Sep. 2019
- “Observation of gravitational waves through precision stellar redshift measurement”
High School Research Program conference, Brookhaven National Laboratory 16 Aug. 2013

Poster Presentations

- “Hybrid analytic image modeling and image moments approach to gravitational lensing”
First-year graduate student presentations, Drexel University 11 Jun. 2019
- “Dark matter and its alternatives”
High School Research Program conference, Brookhaven National Laboratory 27 Nov. 2012

SOFTWARE DEVELOPED

Authored

- F-SHARP** Code for computing weak gravitational lensing correlations. *Publicly available code written in Python.* <https://github.com/evanjarena/F-SHARP>
- Lenser** A tool for measuring weak gravitational flexion. *Publicly available code written in Python.* <https://github.com/DrexelLenser/Lenser>
- 21cmMG** A suite for probing modified gravity with 21 cm cosmology. *Publicly available code written in Python.* <https://github.com/evanjarena/21cmMG>
- Fisher21cm** Fisher forecast for a general 21 cm experiment. *Publicly available code written in Python.* <https://github.com/evanjarena/Fisher21cm>

Contributed

- LensTools** Useful computing tools for weak lensing analyses. *Publicly available code written in Python.* <https://github.com/apetri/LensTools>

TEACHING

Drexel University

Teaching Assistant (Recitation and Lab Instructor)

PHYS 100, *Preparation for Engineering Studies*

Winter: 2021, 2020, 2019

PHYS 152, *Introductory Physics I*

Spring: 2022, 2021, 2020, 2019

PHYS 154, *Introductory Physics III*

Fall: 2021, 2020, 2019, 2018

Grader

PHYS 131, *Survey of the Universe*

Winter 2022

PHYS 231, *Introductory Astrophysics*

Winter 2022

Guest Lecturer

PHYS 231, *Introductory Astrophysics*

Winter 2022

Stony Brook University

Lecturer

Della Pietra High School Applied Math Program

Spring 2017

PROFESSIONAL ACTIVITIES AND SERVICE

Collaborations External Collaborator, Dark Energy Survey (DES)
Member, Packed Ultra-wideband Mapping Array (PUMA) [Inactive]
Member, Baryon Mapping eXperiment (BMX) [Inactive]

Working Groups Member, DOE Cosmic Visions Dark Energy 21 cm Working Group [Inactive]

Outreach Activities

Invited to appear on the Drexel University Teaching Assistant Orientation Panel, as part of the Teaching Assistant Orientation and Preparation Course GRAD T580 (17 Sep. 2020).

Gave a physics demonstration at the Kaczmarczik Lecture Series Open House, hosted by the Drexel University Department of Physics (14 Nov. 2018).

Committee Work

Treasurer of the Drexel University Physics Graduate Student Association (2020 – 2021).