EVAN J. ARENA

Ph.D. Candidate ◇ Deptartment 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,"* Phys.Rev.D **106**, 064019 (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., Perdereau, 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 Phyics 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).