SEAN C. LEWIS

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RESEARCH INTERESTS

Computational astrophysics, 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 — 2017 – Present
M.S. in Physics — 2019

California Polytechnic State University
B.S. in Physics — 2016
Cum Laude

POSITIONS HELD

Drexel University — 2017 – Present
Doctoral Teaching Fellow; Research Fellow
Department of Physics

California Polytechnic State University — 2015 – 2016
Research Assistant
Department of Physics

AWARDS AND HONORS

Department of Physics Teaching Excellence Award, Drexel University — 2019
Chambliss Astronomy Achievement Honorable Mention, American Astronomical Society — 2020
CoAS Dean Honors List, California Polytechnic State University — 2012–2016

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. **Lewis, S. C.**, McMillan, S. L. W., Mac Low, M-M., Cournoyer-Cloutier, C., Polak, B., Wilhelm, M. J. C., Tran, A., Sills, A., Portegies Zwart, S., Klessen R., and Wall, J. E., *"Early Forming Massive Stars Suppress Star Formation and Hierarchical Cluster Assembly,"* Submitted to ApJ (2022)

2. Cournoyer-Cloutier, C., Tran, A., **Lewis, S. C.**, Wall, J. E., Harris, W. E., Mac Low, M-M., McMillan, S. L. W., Portegies Zwart, S., and Sills, A., *"Implementing primordial binaries in simulations of star cluster formation with a hybrid MHD and direct N-body method",* MNRAS **501**, 4464–4478 (2021) [arXiv:2011.06105]

1. Bennert, V., N., Loveland, D., Donohue, E., Cosens, M., **Lewis, S. C.**, Komossa, S., Treu, T., Malkan, M. A., Milgram, N., and Flatland, K., *"Studying the O III λ5007 Å emission-line width in a sample of ∼ 80 local active galaxies: a surrogate for σ",* MNRAS. **481**, 138–152 (2018) [arXiv:1808.04821]

CONFERENCES AND TALKS

Contributed Talks

"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

"Quantifying the Effects of O-type Star Formation in Embedded Stellar Clusters"
Modest 21a Virtual Conference — Jul. 2021
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

"The Effects of Early Massive Star Formation: Gas Expulsion and Cluster Dynamics"
American Astronomical Society – 238th Conference — Jun. 2021

"The effects of O-type star formation in embedded stellar clusters."
American Astronomical Society – 236th Conference — Jun. 2020

"Was the first observed hypervelocity globular cluster,
HVGC-1, accelerated by a supermassive binary black hole?"
American Astronomical Society – 233rd Conference — Jan. 2019

"The mystery of a hypervelocity globular cluster: is a binary black hole to blame?"
Drexel Emerging Graduate Scholars, Drexel University — Sept. 2018

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).