SEAN C. LEWIS

Ph.D. Candidate ◇ Deptartment of Physics ◇ Drexel University
Philadelphia, PA 19104, USA
sean.christian.lewis@drexel.edu

RESEARCH INTERESTS

Computational astrophysics, including the formation of evolution of star clusters, the impact of massive stars and stellar feedback, and software development for migrating astrophysical simulation codebases.

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
Teaching Fellow; Research Fellow
Department of Physics

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

AWARDS AND HONORS

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

RESEARCH HISTORY

2021-Present — **Hydrodynamical Simulation Data Structure Conversion**
Developed a novel software technique for transferring simulation data from a Voronoi mesh data structure to a block-based adaptively refined grid structure utilizing matrix manipulation and interpolation.

2018-Present — **Early Forming Massive Stars**
Developed a controlled experiment using the the high performance coupled magnetoydrodynamic, radiation, and N-body software suite Torch to determine the effects of the formation time of very massive stars, an under-tested parameter space. Time series data analysis and cluster identification techniques revealed that early forming massive stars had significant effect on star cluster development and evolution.

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 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

- "The Effects of Early Forming Massive Stars & A Novel Method for Inter-codebase Interpolation"
  Clusters 2022, McMaster University — 23 Aug. 2022
- "Quantifying the Effects of O-type Star Formation in Embedded Stellar Clusters"
  Modest 21a Virtual Conference — Jul. 2021
- "Using the MHD code FLASH to create a protoplanetary disk"
  Phyics Ph.D. Candidacy Exam, Drexel University — 4 Jun. 2019

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

`VorAMR` — A robust tool that utilizes `numpy` matrix manipulation, `scipy` nearest neighbor interpolation and the AMUSE software suite to convert output data from any Voronoi mesh data structure to input data for adaptive block-based structures. *Publicly available code written in Python.* https://bitbucket.org/torch-sf/voramr/src/main

`PythonOpenMPI` — A generalizable utility for efficient task-based parallel programming using the `mpi4py` library. *Publicly available code written in Python.* https://github.com/seanlabean/PythonOpenMPI

Contributed

`Torch` — A star cluster formation simulation software suite that couples the AMUSE framework with the magnetohydrodynamical code FLASH. *Publicly available code written in Python.* https://bitbucket.org/torch-sf/torch/src/main/src/