# SEAN C. LEWIS

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## RESEARCH INTERESTS

**Computational physics**, including the use of Lagrangian grid codes, magnetohydrodynamics, and radiative transfer to model the formation of evolution of star clusters, the impact of massive stars and stellar feedback, and the pursuit of self-consistent star formation. In addition: to employ and enhance Lagrangian models to study high energy events.

## 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.

## REFEREED PUBLICATIONS

6. Cournoyer-Cloutier, C., Sills, A., Harris, W. E., Appel, S., **Lewis, S. C.**, Polak, B., Wilhelm, M. J. C., Mac Low, M-M., McMillan, S. L. W., Portegies Zwart, S., *"Early Evolution and 3D structure of Embedded Star Clusters,"* MNRAS **521**, 1338–1352 (2023)

5. Wilhelm, M. J. C., Portegies Zwart, S., Cournoyer-Cloutier, C., **Lewis, S. C.**, Polak, B., Tran, A., Mac Low, M-M., McMillan, S. L. W., *"Radiation shielding of protoplanetary discs in your star-forming regions",* MNRAS **520**, 5331–5353 (2023)

4. **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",* ApJ **944**, 211 (2023)

3. Wilhelm, M. J. C., Portegies Zwart, S., Cournoyer-Cloutier, C., **Lewis, S. C.**, Polak, B., Tran, A., Mac Low, M-M., and McMillan, S. L. W., *"Modeling protoplanetary disk evolution in young star forming regions",* Proceedings of the International Astronomical Union, **16(S362)**, 300–305 (2023)

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)

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)

## PAPERS IN PREP

2. **Lewis, S. C.**, Mac Low, M-M., McMillan, S. L. W., Li, H., *"VorAMR: transfer of data from a Voronoi mesh to an adaptive mesh for self-consistent top-down star formation,"* to be submitted (2023)

1. **Lewis, S. C.**, Mac Low, M-M., McMillan, S. L. W., Li, H., *"Star-by-star cluster formation from self-consistent giant molecular clouds,"* to be submitted (2023)

## CO-PI GRANTS

1. Accelerate ACCESS PHY220160: *"Models of Star Cluster Formation Using a Multiphysics Framework"* - 1.675 Million credits awarded Jan.2023

## CONFERENCES AND TALKS

### Contributed Talks

–"Star Cluster Formation: The effects of early forming massive stars and building a bridge between Voronoi mesh and block-structured codes"
American Astronomical Society – 241st Conference Jan. 2023

–"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

## 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.* [Bitbucket Repository]

`PythonOpenMPI` A generalizable utility for efficient task-based parallel programming using the `mpi4py` library. *Publicly available code written in Python.* [Github Repository]

### 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.* [Bitbucket Repository]