

# SEAN C. LEWIS

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## RESEARCH INTERESTS

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**Computational astrophysics**, including the formation and evolution of star clusters, the impact of massive stars and stellar feedback, and software development for converting astrophysical simulation data sets to be accessible by different codebases.

## EDUCATION

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### 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

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### 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

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*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

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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 magnetohydrodynamic, 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

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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](https://arxiv.org/abs/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  $\lambda 5007$  emission-line width in a sample of  $\sim 80$  local active galaxies: a surrogate for  $\sigma$* ”, MNRAS. **481**, 138–152 (2018) [[arXiv:1808.04821](#)]

## PAPERS IN PREP

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3. 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*” to be submitted to MNRAS (2023)
2. 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” to be submitted to MNRAS (2023)
1. **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)

## CONFERENCES AND TALKS

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### Contributed Talks

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- “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

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- “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

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### Authored

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| VorAMR        | A robust tool that utilizes <b>numpy</b> matrix manipulation, <b>scipy</b> nearest neighbor interpolation and the <b>AMUSE</b> software suite to convert output data from any Voronoi mesh data structure to input data for adaptive block-based structures. <i>Publicly available code written in Python.</i> <a href="https://bitbucket.org/torchsf/voramr/src/main">https://bitbucket.org/torchsf/voramr/src/main</a> |
| PythonOpenMPI | A generalizable utility for efficient task-based parallel programming using the <b>mpi4py</b> library. <i>Publicly available code written in Python.</i> <a href="https://github.com/seanlabeau/PythonOpenMPI">https://github.com/seanlabeau/PythonOpenMPI</a>   |

### Contributed

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## 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/>