



TARDIS

TARDIS is a collection of tools to analyze observations from exploding stars and is widely adopted in the astrophysical community for cutting edge science.

TARDIS is a multi-disciplinary open source collaboration applying new tools from artificial intelligence research and high-performance computing with an open-source development structure.

APPLICATIONS

TARDIS has been participating in GSoC since 2015, mentoring over 14 students from diverse educational backgrounds. In addition, we have trained several other undergrad & PhD students in the best practices of software development that has helped them in their careers.

TARDIS is used to measure cosmic distances by modeling Type Ia and Type II-P supernovae, the explosions of massive stars. This is integral to the knowledge of how the universe expands, including the existence of dark energy. Recent advances have been made possible with machine learning techniques to accelerate TARDIS simulations.

TARDIS has been utilized for the study of the only observed merger of binary neutron star systems to try and identify the presence of r-process material in the ejecta.

PLANNED FEATURES

- + Visualization tools: TARDIS is used to explore potential models for observed supernovae, and it is often difficult to find optimal parameter values. We plan to develop new visualization tools and graphical interfaces that will allow users to visually inspect their models and obtain physical information from the TARDIS simulations easily.
- + Performance improvements with Numba: In the past, TARDIS has used Cython and C for performance-critical parts of the code. By using Numba, we aim to minimize the complexity of the code so that it can be understood by a wider audience while maintaining the performance.
- + TARDIS Model Code Restructure: Currently the TARDIS collaboration is working on a code restructure to make the internal model class more modular. This will facilitate more straightforward user access and the addition of new class properties and functionality.

PROJECT NEEDS

Nebular stage physics implementation	\$300,000
Interface TARDIS with High-Performance Computing	\$70,000
Science Testing Pipeline that re-runs TARDIS models and compares them to results generated from the newest version of TARDIS	\$7,000



For more information on TARDIS, including our governance structure and project roadmap, please visit

<https://tardis-sn.github.io/tardis/>

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