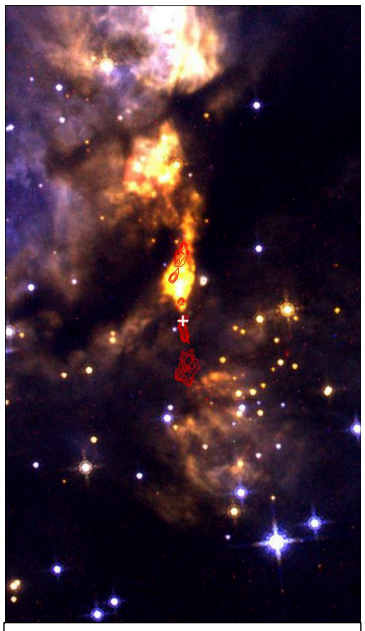
Masters thesis project in Space, Earth and Environment

Observational Studies of Massive Star Formation

Background



Massive protostar G35.2 as observed by our group with the Hubble Space Telescope and Very Large Array (from Fedriani et al. 2019, Nature Comm.

Stars with masses greater than about eight times that of the Sun play crucial roles in the evolution of the universe. These stars produce intense, high-energy radiation fields that ionize the gas of interstellar and intergalactic space. They end their lives in violent supernova explosions that enrich their surroundings with chemical elements heavier than H and He. Massive stars tend to form in star clusters, which are the environments in which most stars, perhaps including our own Sun, were born. In spite of this importance, many open questions remain to be answered about how massive stars and star clusters form from molecular clouds. This Master's thesis project is focused on observational studies of the process, which can range from analysis of data from space telescopes observing in the X-ray (i.e., Chandra) and optical/near-infrared (e.g., Hubble), airborne telescopes observing across the infrared spectrum (i.e., SOFIA) to ground-based telescopes, especially at sub-mm and mm radio wavelengths (e.g., ALMA). These data will be analyzed to test different theoretical models of massive star and star cluster formation. A technical review article on this topic is here: https://arxiv.org/abs/1402.0919. A lecture about this research topic is here: https://youtu.be/jPHiBxlse2w. More background information on Prof. Tan's research is here: http://cosmicorigins.space/tan.

Task description

Precise tasks will be determined depending on the particular interests of the student, however, example aspects can include analysis of Chandra, Hubble, SOFIA or ALMA data that has been collected recently by Prof. Tan's research group. Statistical analyses to allow quantitative comparison with theoretical models is expected.

Required education and potential course requirements

"Interstellar Medium and Star Formation" (RRY041 for Chalmers; ASM480 for Gothenburg Univ.) is highly recommended for this Master's research project, as it reviews astrophysics relevant to the research. "Radio Astronomical techniques & interferometry" (RRY131) is also recommended, especially if the project is to involve working with ALMA data. A program of individual reading will also be supervised as part of this thesis. Computational programing skills, e.g., Python, C++, etc., are helpful, but may also be developed as part of this thesis.

Credits: 30 or 60 credits

Starting time

The project can start in January 2021, but earlier contact and preparatory activities are highly encouraged to maximize the chance that the work leads to a refereed publication.

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