ASTR240/540 Final Project Proposal

Due September 28 at the start of class

Project description: For your final project, you have a choice between two types of projects.

1) You can study a literature example of an ALMA data analysis issue. You should (1) reproduce the original (likely incorrect) result, (2) reproduce the updated (likely correct) result, and (3) write a tutorial (in the style of CASA Guides) to explain how the problem can be avoided/mitigated for future observations. I have identified three examples that deal with different types of data analysis issues.
    a. *The effect of unanticipated source variability on interferometric imaging*. The story here is that one group observed Proxima Cen and reported a debris disk around the star (Anglada et al. 2017). However, subsequent reanalysis of the data demonstrated that the first group had not noticed a stellar flare during their observations, which led to a spurious disk detection (MacGregor et al. 2018).
    b. *The difficulty of imaging extended structure*. In this case the ALMA pipeline missed the debris disk detection, and the authors posted an early version of the paper on the arXiv in which they reported a nondetection of the disk. Then a colleague looked at the data and alerted them that a detection had been missed. The publication that resulted was Bayo et al. (2019). (The previous version, which reports a nondetection, can still be viewed on arXiv.)
    c. *Spectral line planetary imaging*. This would be by far the most complex of the three projects technically, and the most controversial because there are still active discussions ongoing about the data analysis methods and whether or not the original detection is correct. However, I think it could be exciting and timely for one of the groups to dig into the data that led to the report of phosphine in the atmosphere of Venus (Greaves et al. 2020) and at least one of the subsequent papers critiquing their reduction and analysis of the ALMA data (my preference would be Villanueva et al. 2020, but Snellen et al. 2020 and Akins et al. 2021 are also relevant).

OR

2) You can devise an archival project on a subject of your choosing, subject to the constraints defined below (data should be Cycle 5 or later, and limited to 1-3 data sets). You could reproduce a key figure from a previously published paper, compare two data sets on related topics, or conduct a novel archival investigation – the sky is the limit here! (And I'm happy to discuss ideas with you after class or during office hours.

Here are some guidelines for the proposal document:

Length: Approximately one page (or shorter if you choose one of the literature projects)

Contents:

1) *Names of group members*. Groups should have 3 or 4 members (since there are 18 students in the class, there will be two groups of three).
2) *Subject of interest*. If you choose one of the literature projects, just say which one you choose, and you are done! Otherwise, describe the project motivation and goals, including references to at least one relevant publication.
3) *Data*. Identify 1-3 archival ALMA data sets from Cycle 5 or later that you plan to use for your project. Give the project code, band, source name(s), angular resolution, line (or continuum).
4) *Proposed outcomes*. Describe how you intend to analyze the data, and specific figures you intend to make.