ASTR 511 ALMA Imaging Exercise and Grading Form

Goal: to go through the process of imaging an ALMA data set to better understand interferometric data and the principles discussed in class. What do interferometric data look like? Production of images from visibility data and the effect of weighting and primary beam correction on the output maps.

Student:

You have two options for this project. Note you need to complete only one (with adequate exploration of options as you will document below) for the project, not both.

1. All of the tutorials for CASA beginners (see https://casaguides.nrao.edu/index.php/ALMAguides#Imaging_Tutorials_for_CASA_beginners) use an abridged dataset of TW Hydra. ALMA datasets can be huge (one observation file can be 200 GB easily).
I recommend working your way through these four exercises to get a feel for the data and the impact of different choices in data reduction.

2. If you are interferometric data-savvy and wish to do so, you can instead go to one of the current casaguides for science verification data for this project. If you opt for this, then you can skip the calibrations and use the calibrated data files. The point of this exercise is exploring imaging, not calibration. I do NOT recommend jumping into the polarization or sunspot cases for this exercise.

Tasks (grade breakdown) :

1. keep a journal of your DR experience, be reasonably verbose about the process, what dataset was chosen and what you did to make images and improve them (40%)

Grade:
Comments:

2. Did you use 'mode="mfs"' when cleaning continuum data?
What was its impact (why is it used)? mfs = multi-frequency synthesis. Estimate the noise, dynamic range and flux in the continuum image. (20%)

Grade:
Comments:

3. Vary other parameters in clean (cell, image size etc.) and see how the quality of the output image is impacted. (20%)

Grade:
Comments:

4. do a self-calibration on the dataset and explain improvement (or lack thereof) and briefly summarize why we self-calibrate and what is really being done. Quantify the improvement in dynamic range. (20%)

Grade:
Comments:

Bonus:
1. create a moment 0 and moment 1 map of the object, showing the velocity gradient across and discuss the merits of these images. If you think other moment maps would be more revealing, feel free to explore those. (5%)

Bonus:

2. TW Hydra: estimate the mass of the disk in dust and gas and infer a gas-to-dust ratio for the TW Hya disk and compare to that of the ISM (typically 100:1). (5%)
Other: estimate the dust mass seen in continuum and justify the assumptions made to generate that estimate.

Bonus:

Final Grade: