Resolving the Vertical Structure of AU Mic

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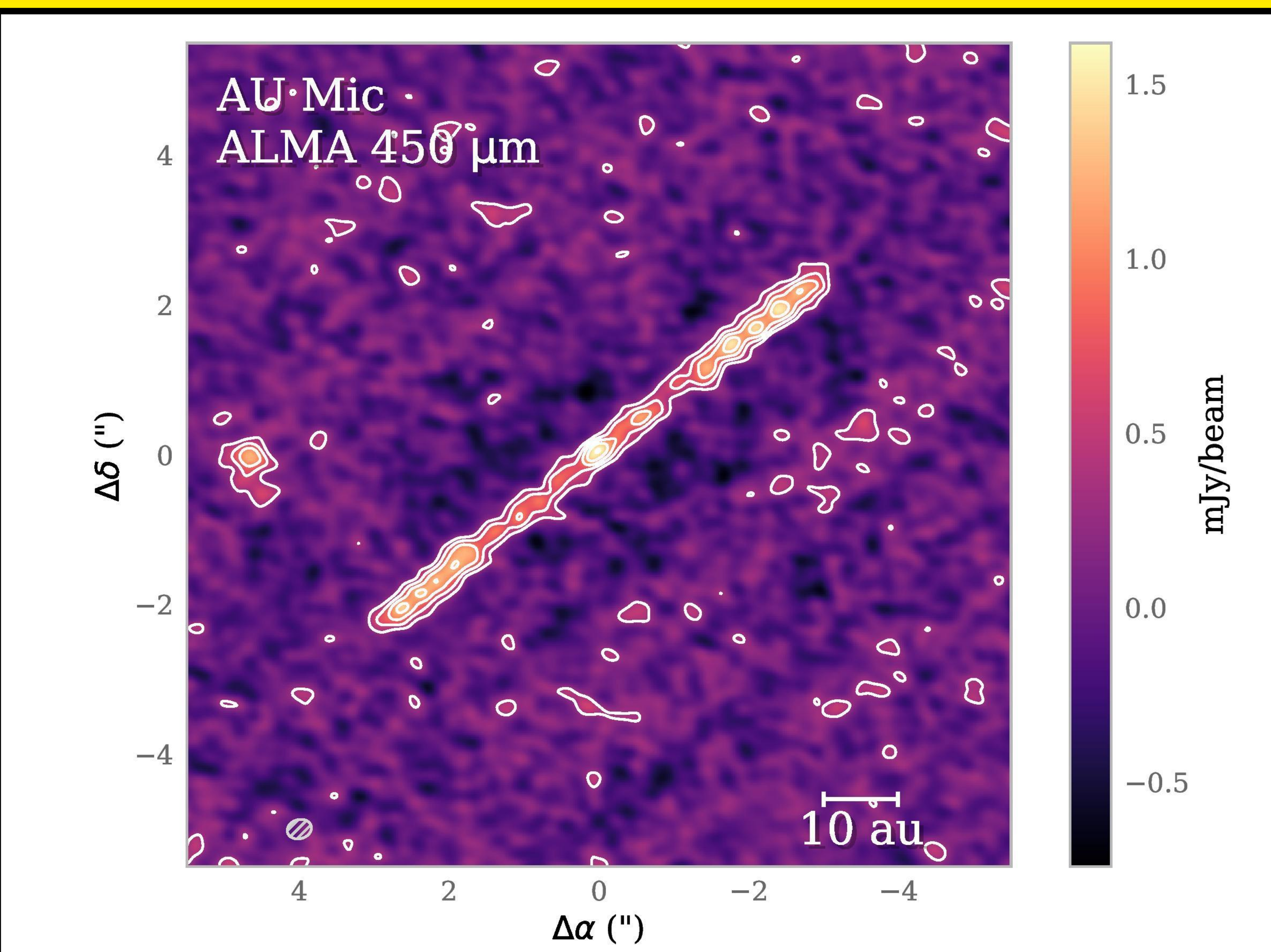
Introduction

- AU Mic is a star located 32.3 light years (ly) away from Earth
- It possesses a debris disk, which is a ring of dust and debris (from large rocks to asteroids and comets)
- Daley et al. (2018) measured the "scale height" of the disk using 1.3 mm radio data from ALMA (Atacama Large Millimeter/submillimeter Array)
- If we can measure the scale height of the disk in another wavelength, we can resolve the vertical structure of the disk
- Resolving the vertical structure will help us test the tensile strengths of bodies in the "collisional cascade," the current model of how bodies interact inside debris disks -- this has **never** been done outside our Solar System!

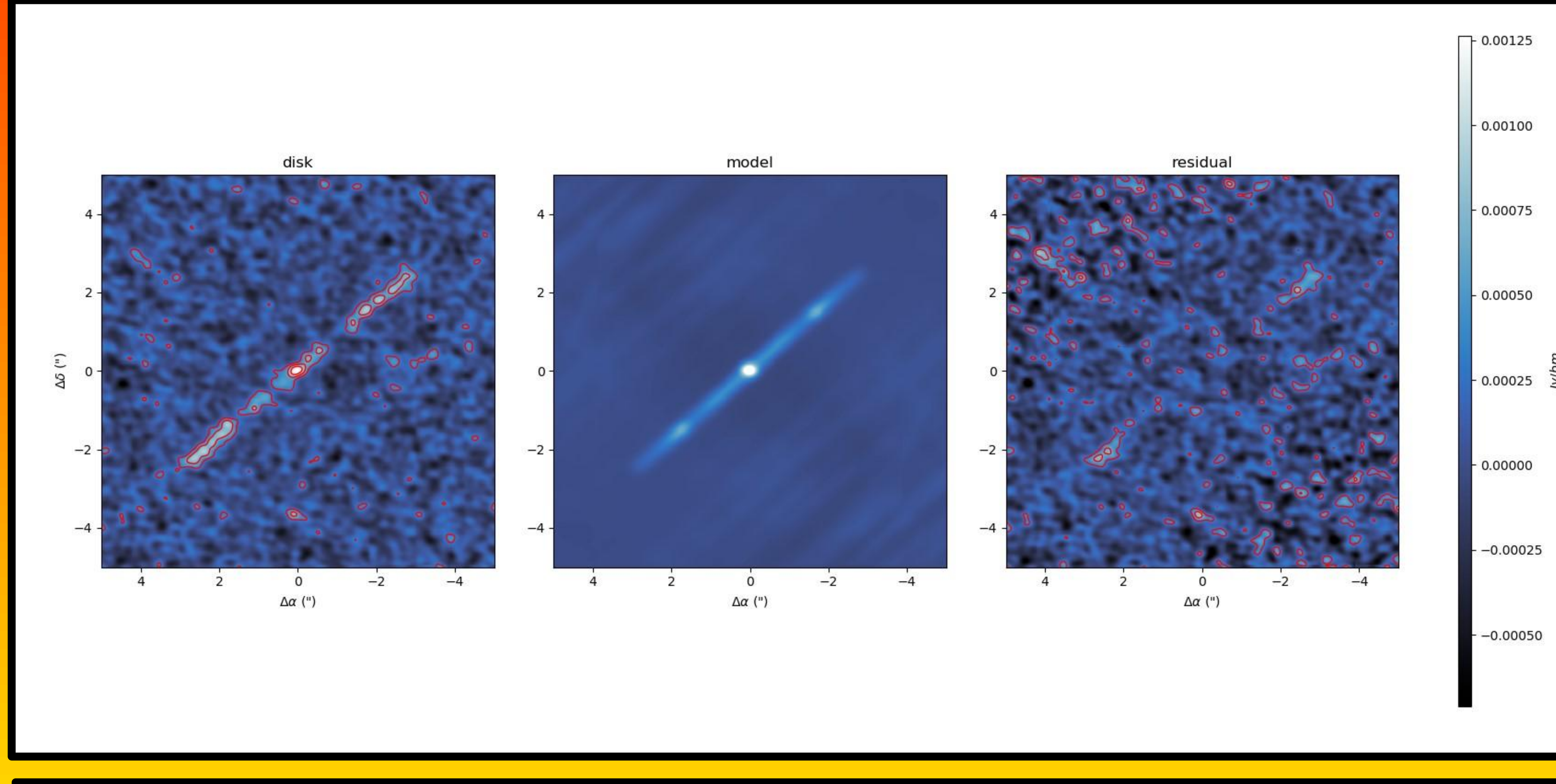


Modelling a disk

- This project made use of modelling code described in Flaherty et al. (2015) which models debris and protoplanetary disks
- We are not just interested in a best-fit model but also the uncertainties on factors like scale height and mass of the disk
- We use a MCMC (Monte-Carlo Markov Chain) to explore the parameter space
- The process is initialized with values for free parameters (disk mass, scale height, disk radii, star flux, etc.) and a disk model, made by these parameters, is converted into visibilities (using *galario*; see Tazzari et al. 2018) which are then compared to the original 450 um data which we use for our analysis.
- The best fit model and uncertainties on free parameters are derived from this process.

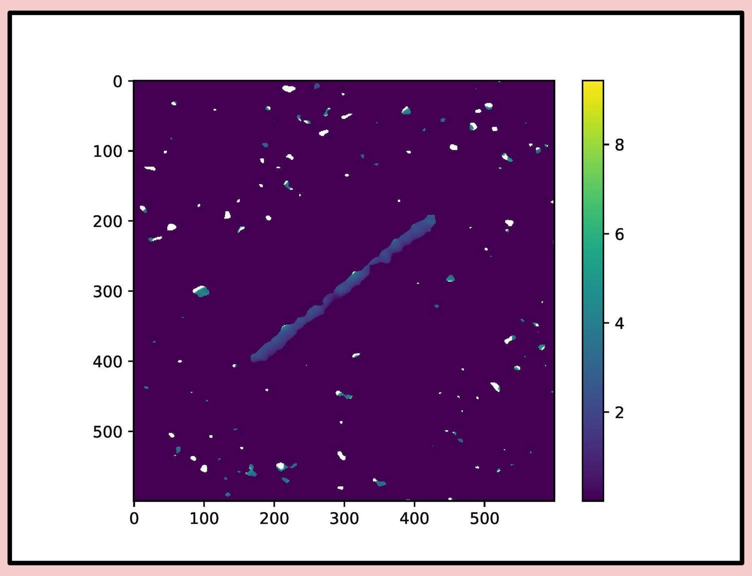
Parameters

Disk mass	How much dust in disk
Inner radius	Inner edge of disk
Outer radius	Outer edge of disk
Transition radius	"Transition" between density laws
Position angle	Tilt of disk in sky
Inclination	0 → face on, 90 → edge on
Star flux	Brightness of AU Mic
Scale height	"Puffiness" of the disk
Power law 1 & 2	Power laws which describe distribution of dust in disk



Where am I now?

- The modelling code can reproduce most of the disk and some parameters are in agreement with Daley et al. (2018)
- However, as shown above, the model struggles to subtract all of the disk flux at the outer edges
  - In the residual plot you can see clear flux blobs that should not otherwise be there
- We are currently investigating whether the difference is due to a primary beam correction problem or whether it reflects non-axisymmetry in the underlying density distribution
  - The latter should be visible in a "spectral index graph" (see below) however there are also problems with the datafile we are using; thus we are investigating how to clean this as well.



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