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Reshaping the Search for Substructures in Young Protostellar Disks

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To date, ALMA has conducted thousands of protostellar disk observations, and studying this archive has revealed much about the nature of these dusty disks around infant stars. Including that many of even the youngest disks contain an indicator of planet formation: axisymmetric substructures. However, the high computational/observational requirements of current methods mean only a small portion of disks have been examined for substructures. My work aims to investigate the prevalence of substructure in young disks by developing a neural network that uses Simulation-Based Inference (SBI) to quickly identify features such as gaps and rings directly from ALMA's raw uv visibilities.

Thus, I have built a data pipeline that creates a training dataset of visibilities by combining real observations of disks with known substructures alongside synthetic observations of real and simulated disks. The thousands of simulated disks are generated with a range of substructures, from simple smooth disks to ones with multiple gaps and rings, and each one is synthetically observed with a range of positional and observational parameter values. This variety ensures that the dataset mimics the breadth of qualities found across real observations.

Once this SBI model is complete, it will be able to identify a disk's most likely substructure(s) in seconds, instead of the hours required by conventional techniques. By creating this model and running it over every viable young disk in ALMA's archive, I aim to shift the current paradigm from analysing individual disks to analysing the presence, form, and statistics of substructure among large disk populations.

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No

If you are selected for a poster, would you be interested in giving a short flash talk on your work?

Yes

What is your career level?

MSc

Which keyword describes the area of focus of this talk?

Other

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