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An Investigation of Mass Transfer in Symbiotic Stars

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What are Symbiotic Stars?

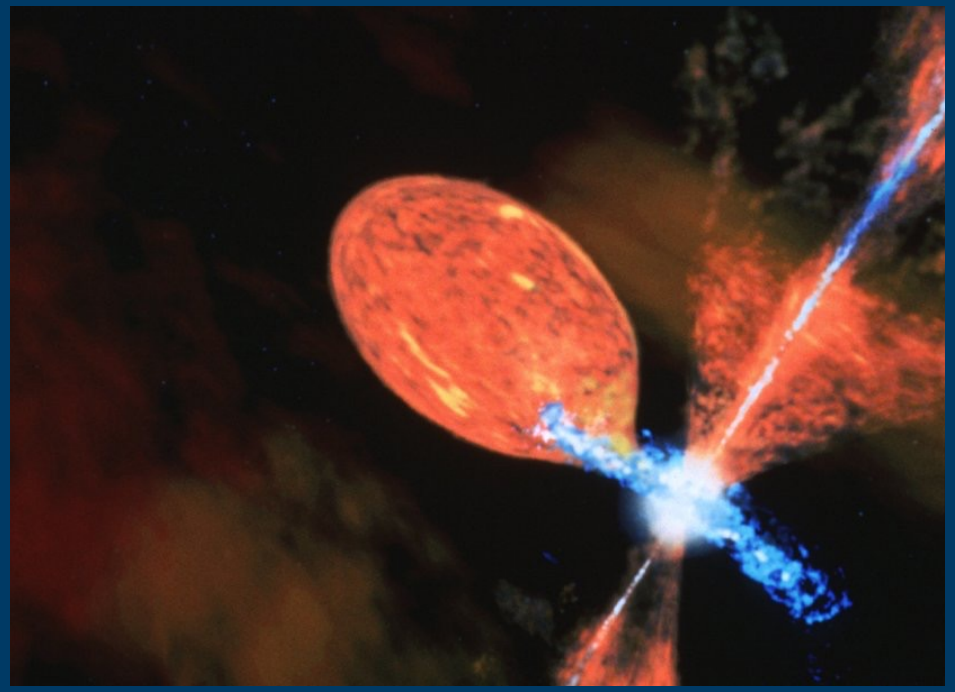

Image courtesy of NASA, ESA, and D. Berry (STSci)

- 3 components:
  - Cool Giant
  - Hot Compact Object
  - Dense Circumstellar Medium
- Interacting Binary Systems
  - Experience active mass transfer
- Connected to several important late-stage stellar objects

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Mass Transfer in Symbiotic Stars

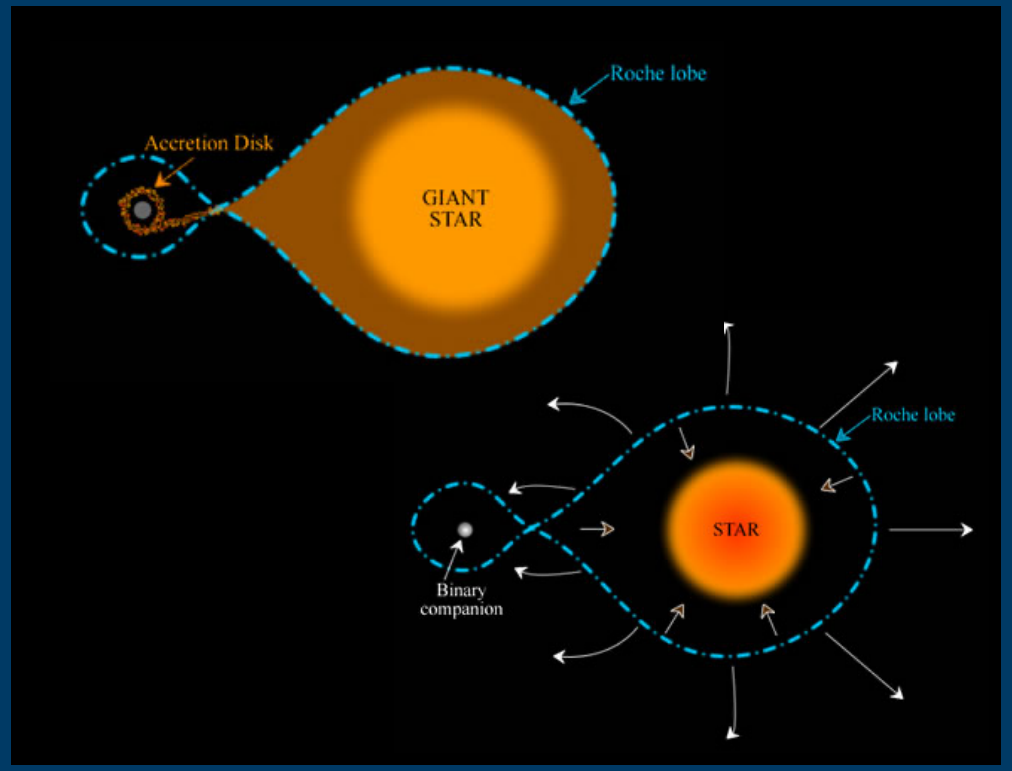

Image courtesy of Swinburne University of Technology

- What mechanism drives mass transfer?
  - Does the star fill its Roche lobe?
  - If not, does the giant's stellar wind play a large role?
- Knowing the mechanism of mass transfer will help inform models for evolution of a system

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How do we best investigate mass transfer?

Image courtesy of Eric Simison, Sea West Enterprises

- Only way to conclusively determine if red giants are distorted.
- We need a way to directly observe the surface of distant stars.
  - Not possible with a single telescope
- Must use the technique of Optical Interferometry to get higher resolution!

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Methodology

Target	Distance (pc)
V1724 Aql	250.4 ± 4.4
EG And	607.8 ± 12.4
BD Cam	234.3 ± 14.2
SU Lyn	728.6 ± 33.4

- Observed 4 nearby symbiotic stars using the CHARA Array
  - Observation dates: 9/20/21 – 9/22/21 UTC
- Used MIRC-X beam combiner with all 6 telescopes for maximum resolution
- Analyzed each target using a combination of model fitting and imaging

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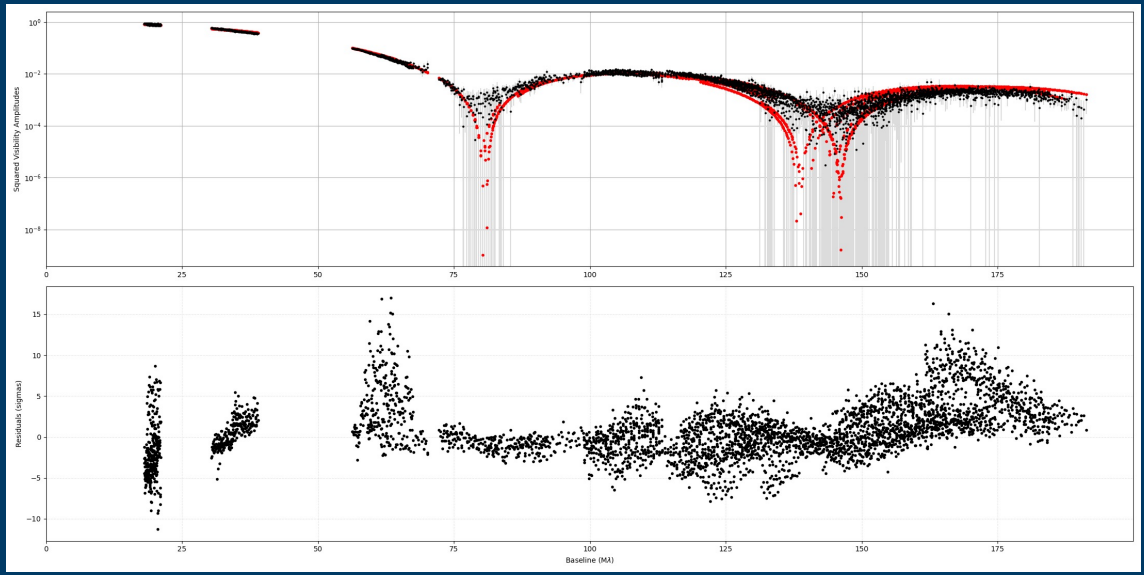
Model Fitting



- Tested geometric models by fitting 3 different models to observed data
- Best-fitting model provides information about the shape of the stellar disk
- Three models:
  - Uniform Disk
  - Elongated Disk
  - Hybrid Uniform/Elongated Disk

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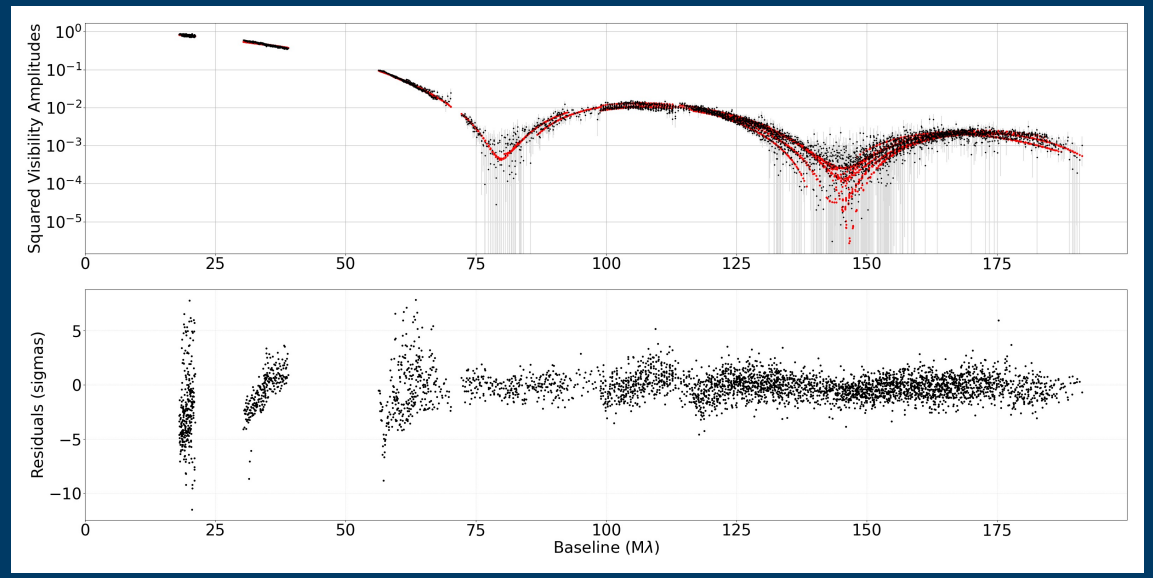
Imaging



- Imaged each target using the software SQUEEZE
  - Image reconstruction tool using stochastic methods
- Compared reconstructions that are given no prior information to those starting from an image of a uniform disk
- Fit the reconstructed image data back to observed data to make sure that the shapes match

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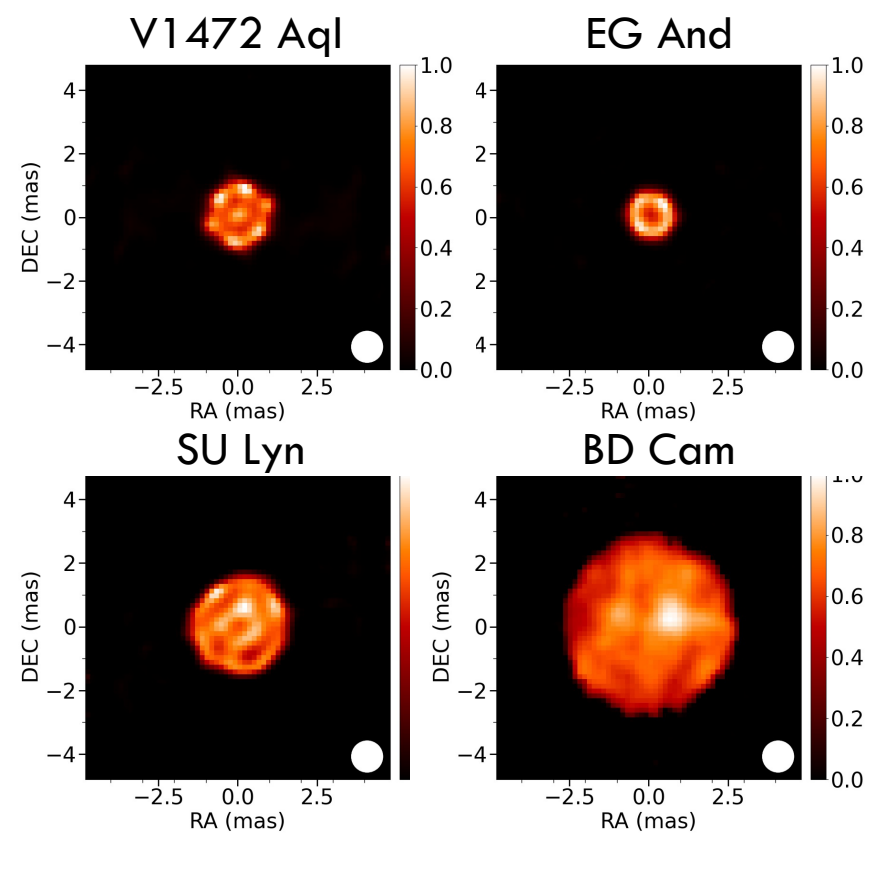
Results



- No evidence that any target is filling its Roche lobe
- V1472 Aql, SU Lyn, and BD Cam all fit best to a hybrid disk model with an elongated component
  - Show clear evidence of asymmetry when imaged
- EG And shows surface features, little evidence of asymmetry

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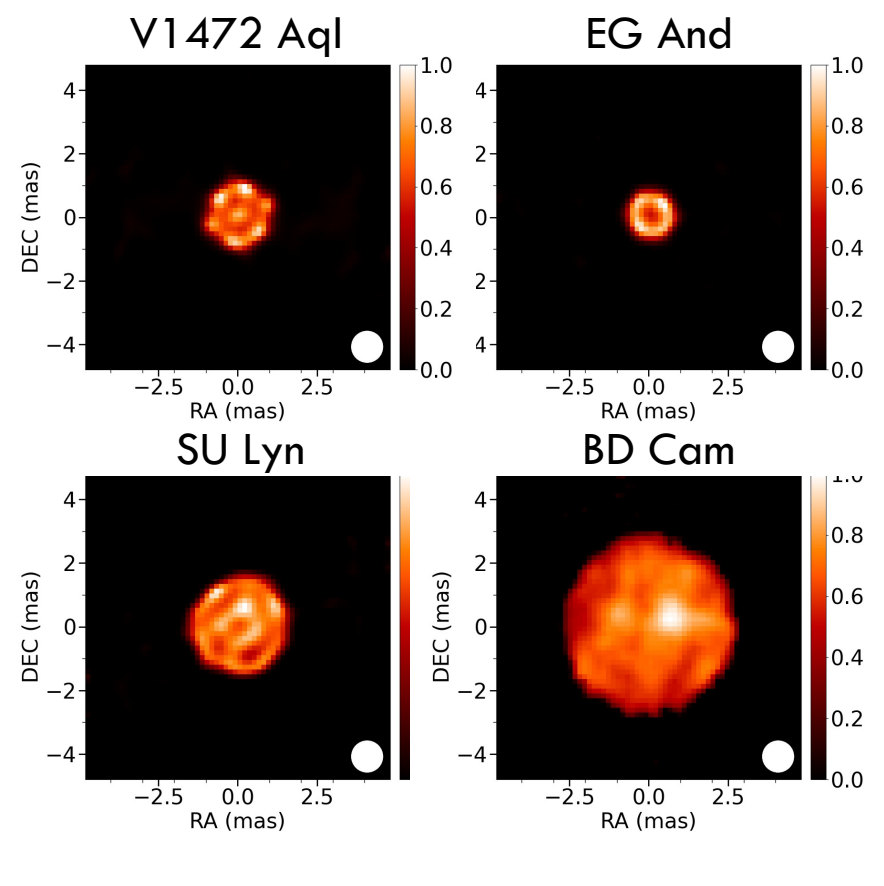
Future Work



- Only seeing each star at one point in the orbit
  - Long term monitoring needed to confirm that the Roche lobe teardrop is not behind the star
- Only observing 4 stars, need to observe more targets to draw more general conclusions

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Questions?