



# 3D Printed Filar Micrometer

Emily Rull

Advisor: Dr. Stephen Case

April 17, 2018

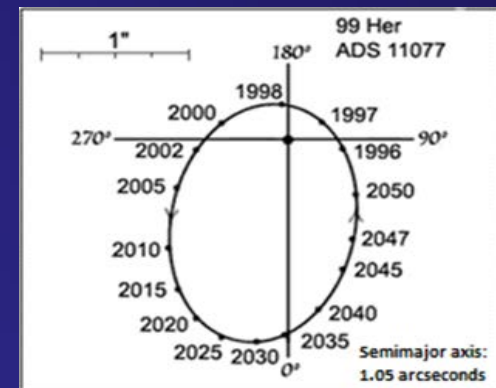
“Double stars are the tinted  
jewels and waltzing couples of  
the night sky”

-James Mullaney



# Double Stars

- Double stars have an observable orbit
- The mass of the double stars can be calculated from this orbit
- The mass of a star is the primary influence on how its life progresses.
- Mullaney states it is the only direct method of calculating stellar mass



# Filar Micrometers

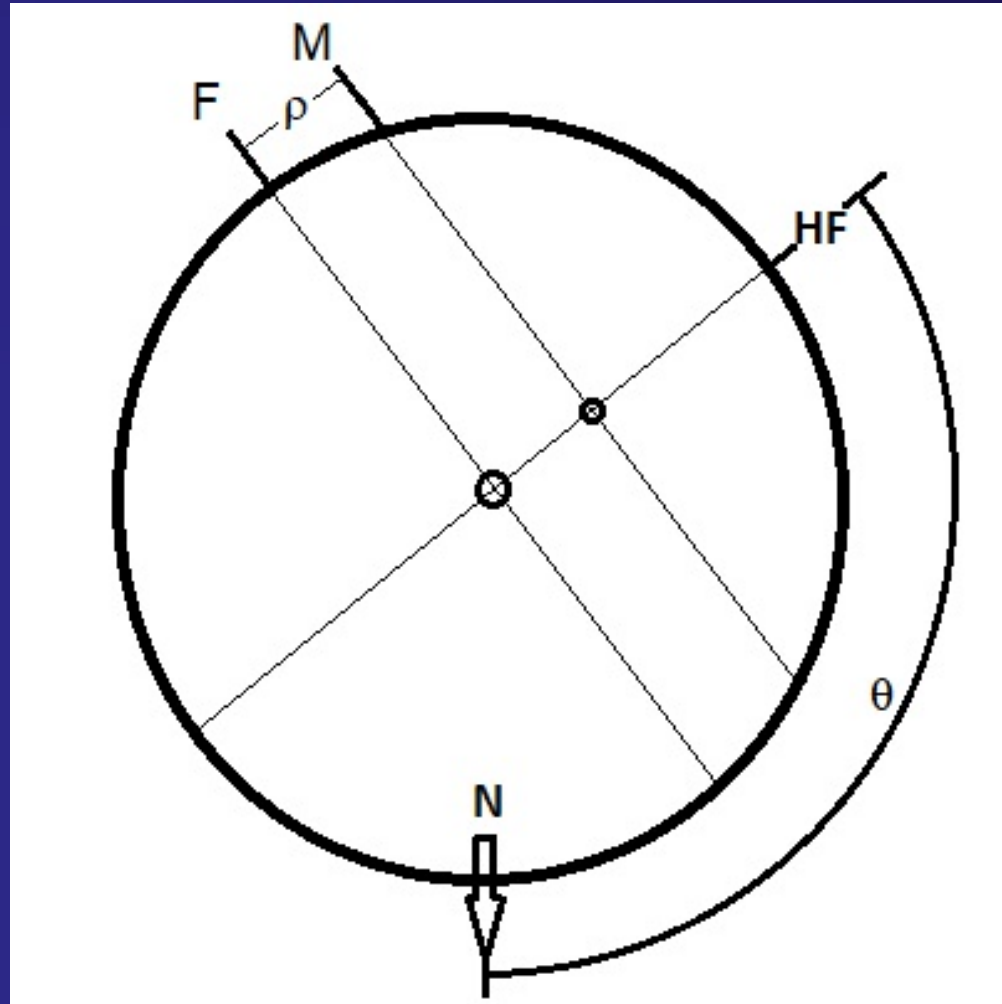
- The closest double star pairs require a visual measurement technique
- Used as primary double star measuring tool from 18<sup>th</sup> to 20<sup>th</sup> century
- Professional astronomers are neglecting the study of double stars
- Amateur astronomers can gather professional data with the right tools



# GOAL

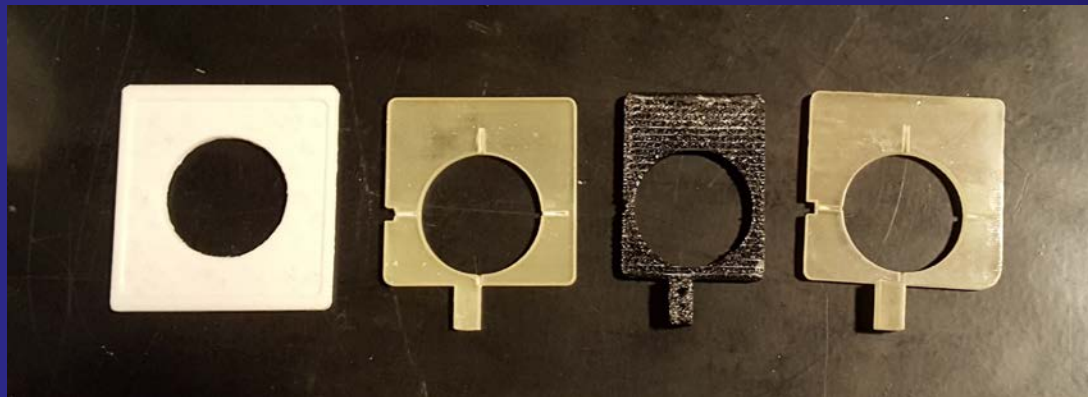
3D print a filar micrometer that could be used by amateur astronomers to measure double stars.

# Using the Filar Micrometer

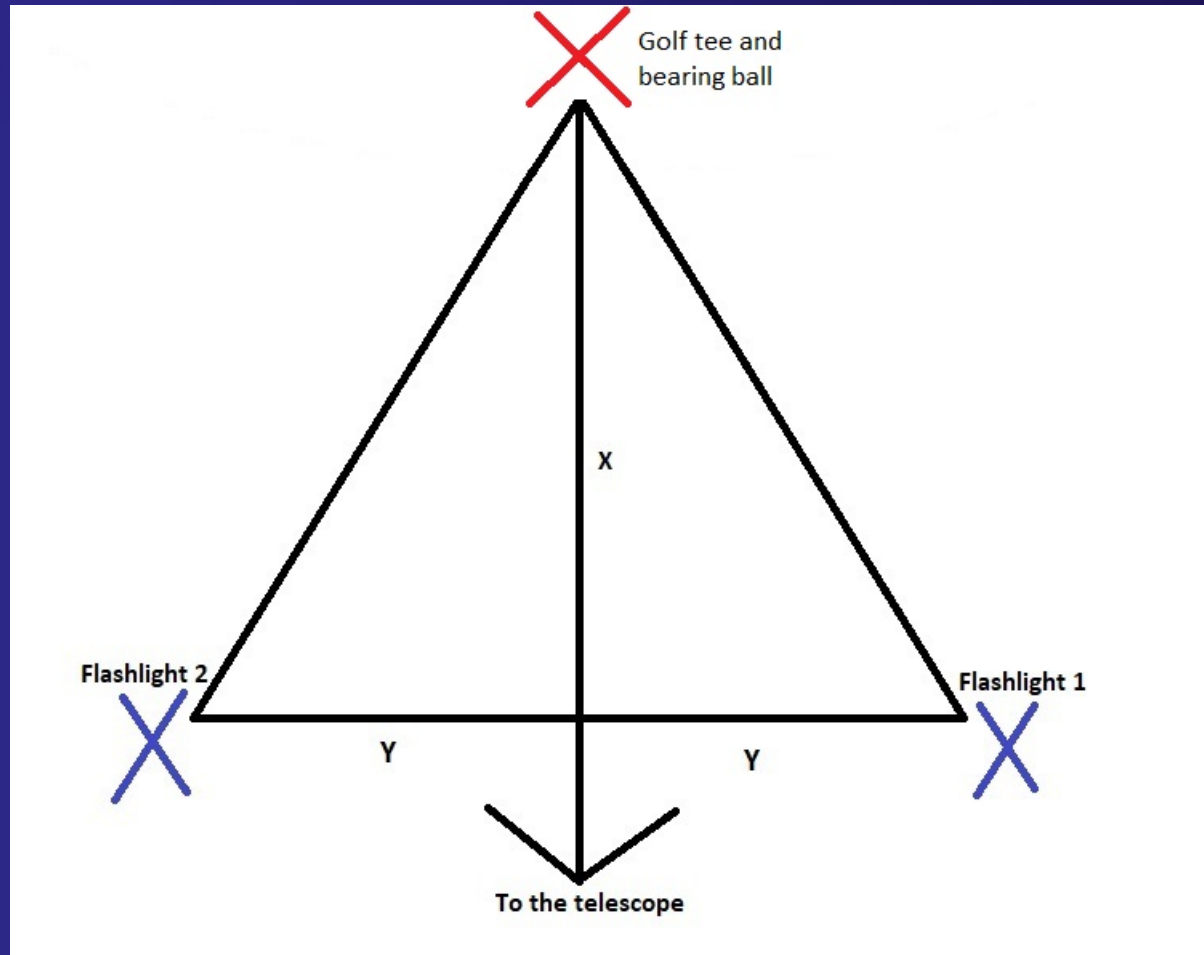


# Methodology

- Researched amateur designs in *Sky & Telescope*
- Design process was iterative with four distinct prints
- Calibrated using Couteau's artificial double star

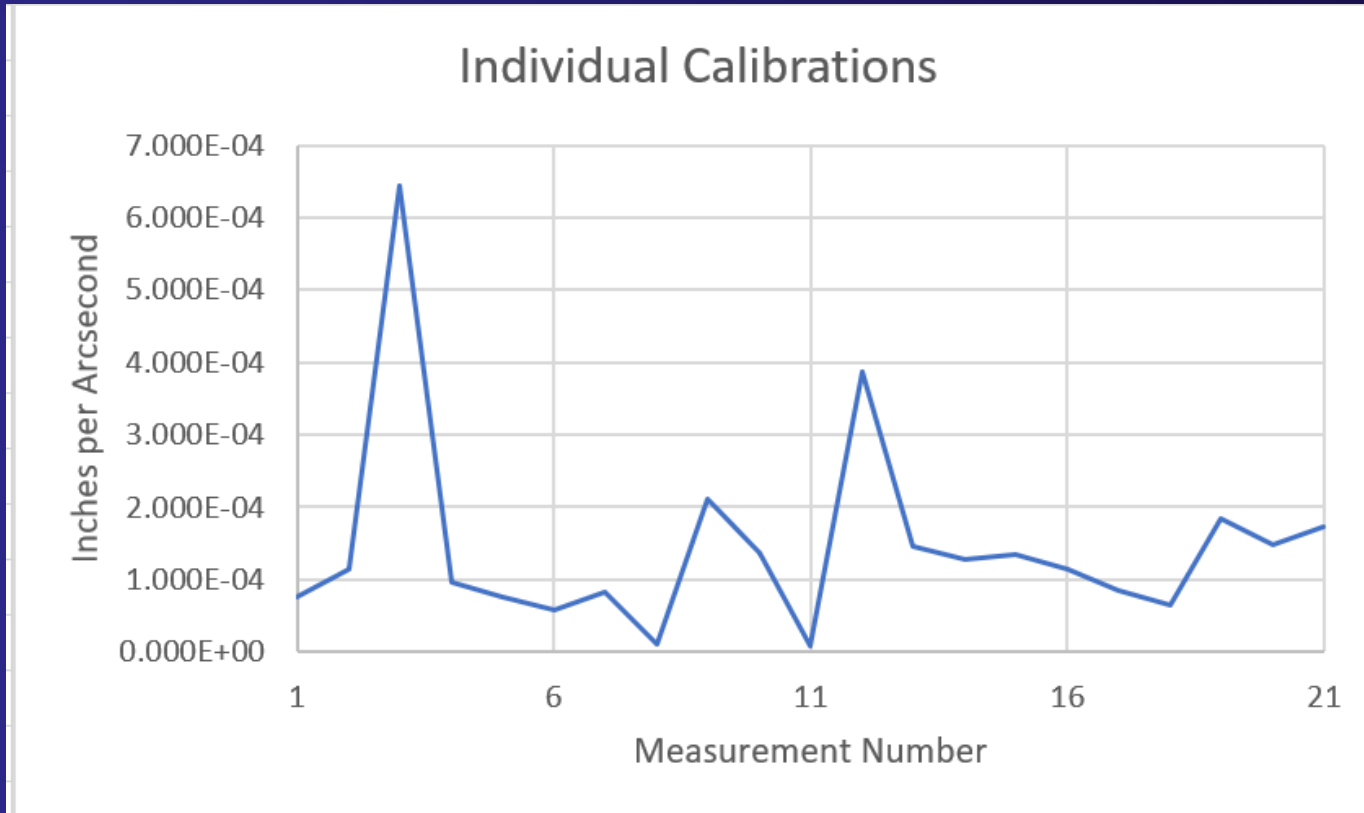


# Artificial Double Star





# Results



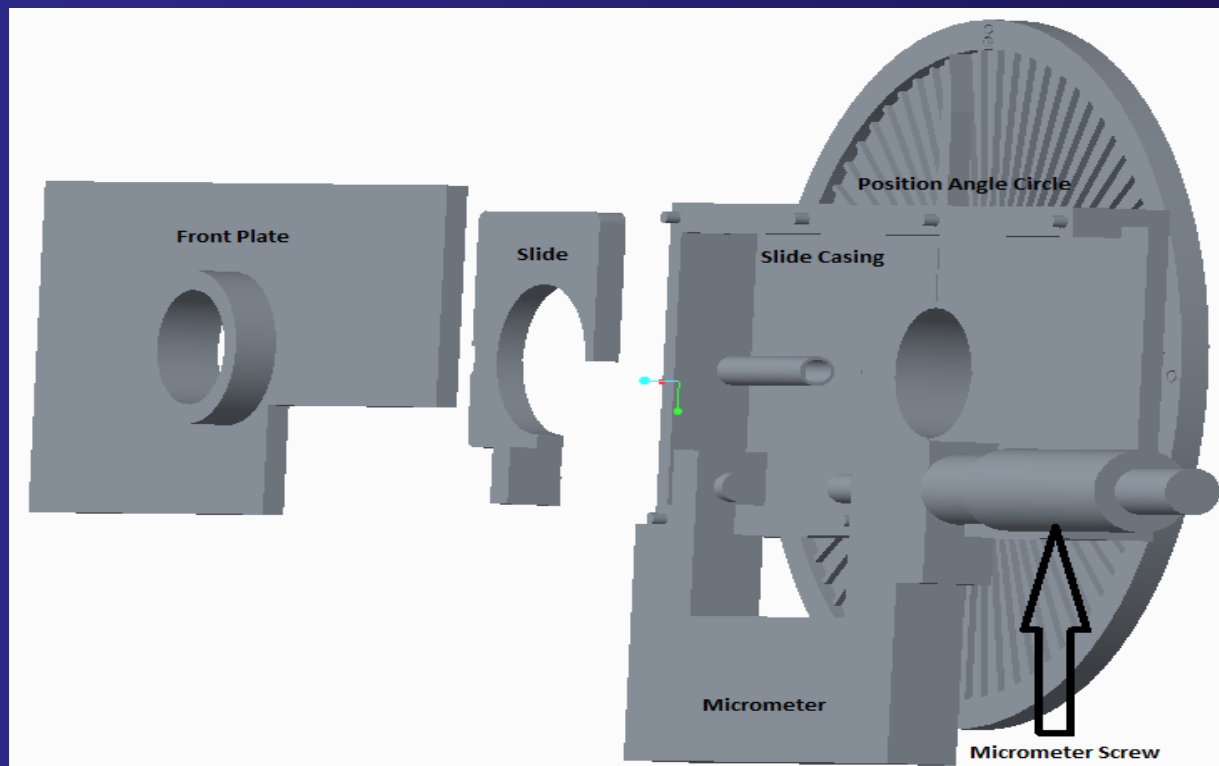
- The collective calibration value is  $1.55\text{E-}4$  inches per arcsecond.
- The calculated percent error of the simulated 24 Coronea Bernices measurements is 16.88%.

# Results

- The final cost includes:
  - Final print
  - Vernier micrometer
  - Nichrome wire
- Final cost comes to less than \$250
- Cost of professionally built filar micrometer is more than \$2500

# Conclusions/Project reflection

- Successful filar micrometer at amateur level achieved.





Thank You

# References

- Couteau, P. (1981). *Observing Visual Double Stars*. (A. Batten, Trans.). Cambridge, MA: The MIT Press. (Original work published 1978).
- Polman, J. (1977). A homemade filar micrometer. *Sky & telescope*, 53, 391-396.
- Robertson, T. (1985). A filar micrometer for comets and double stars. *Sky & telescope*, 69, 359-360.
- <http://www.skyandtelescope.com/observing/colored-double-stars-real-and-imagined/>



# Questions?

Contact me at [Emily.Rull777@gmail.com](mailto:Emily.Rull777@gmail.com)