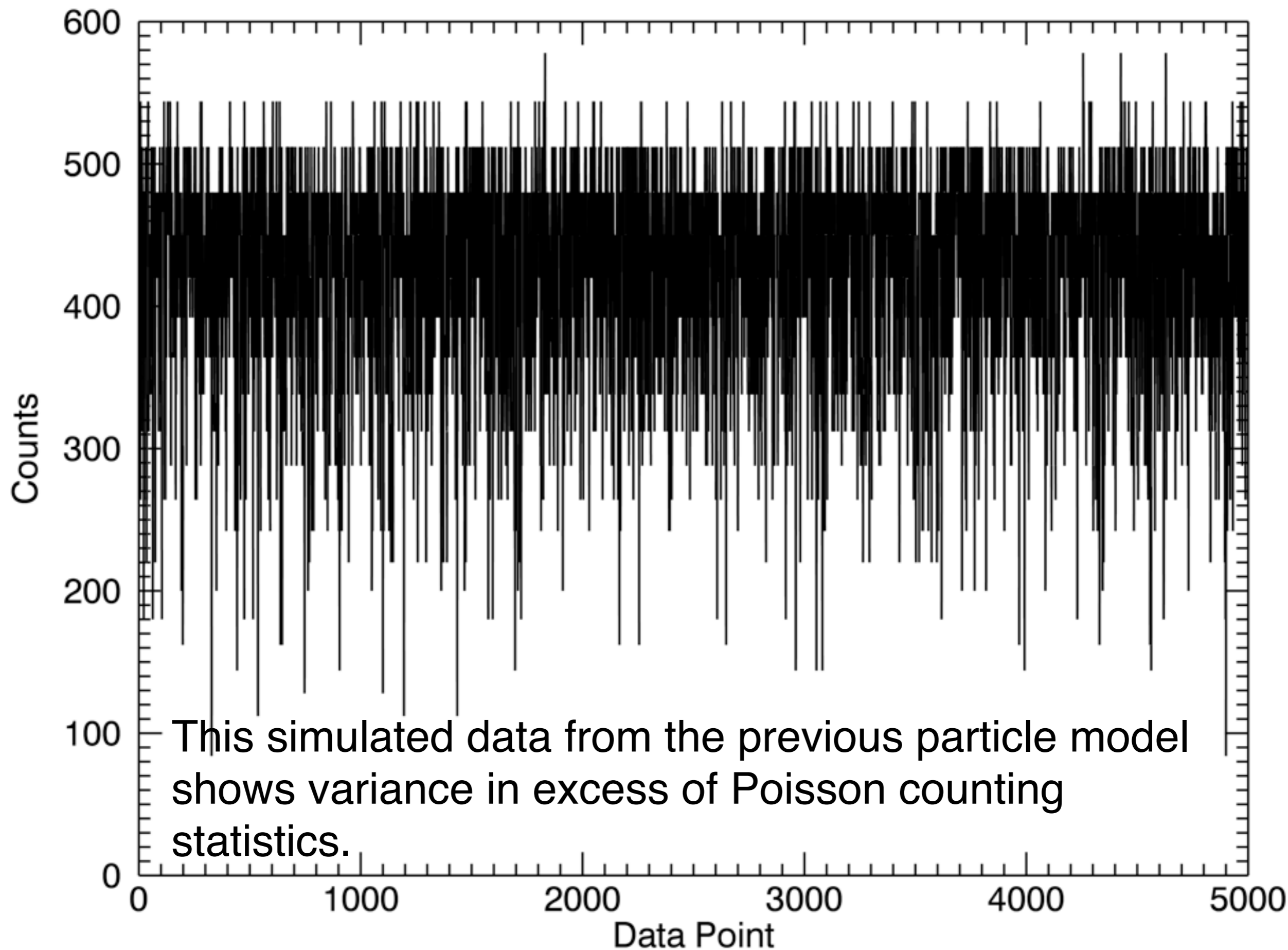


# Studying Sizes and Shapes of Particle Agglomerates from Occultation Statistics

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# Simulated Data



# Particle Autocorrelation Length

Particle Size

Normalized excess variance,  $E$

$$\frac{\pi R_{eff}^2}{\mu A} \approx \frac{\Delta\sigma^2}{I_0^2} \frac{\mu}{\tau e^{-2\tau/\mu}}$$

$A$ =area of region in rings sampled by a single measurement

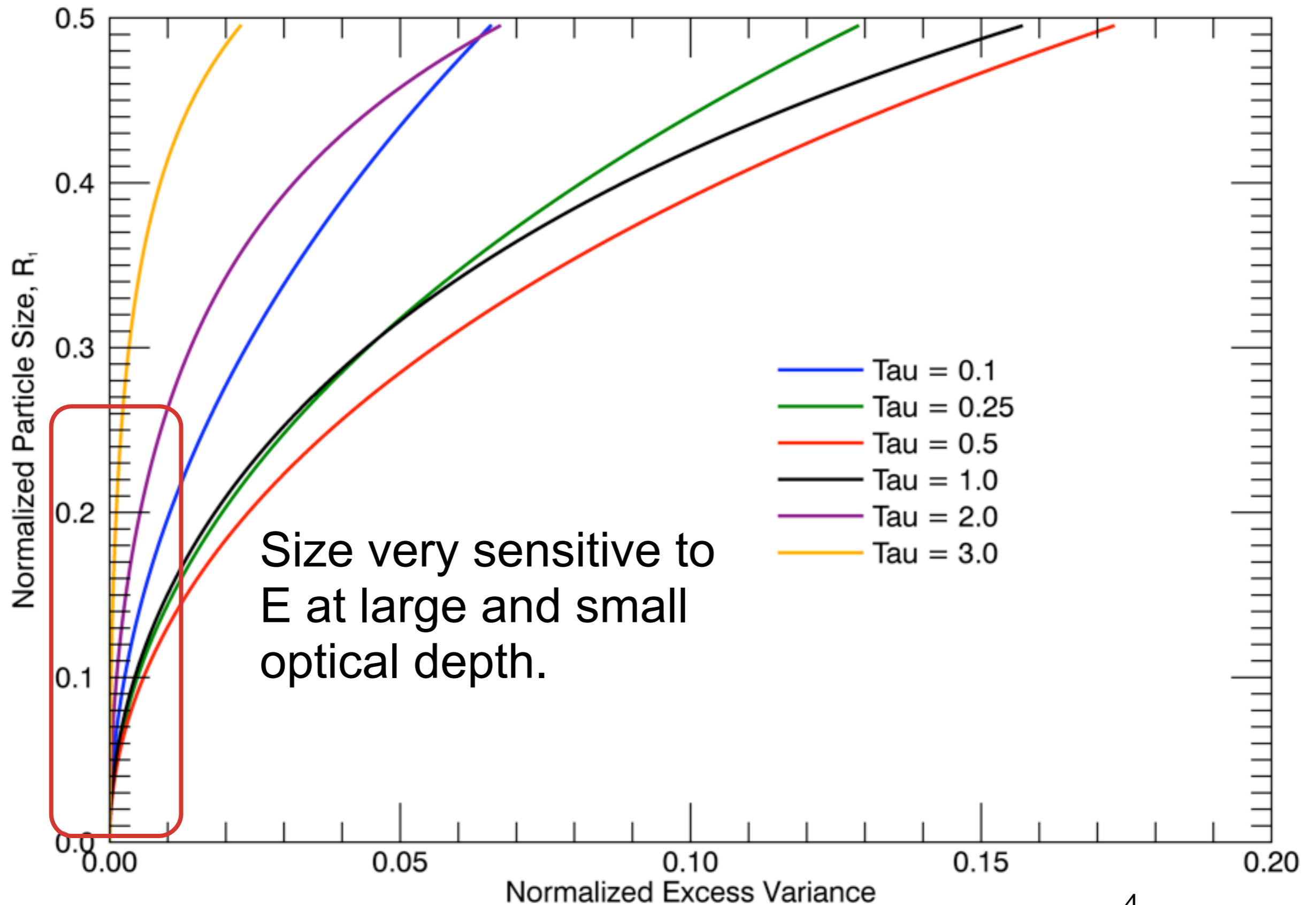
$I_0$ =unocculted stellar signal

$\tau$ =measured optical depth

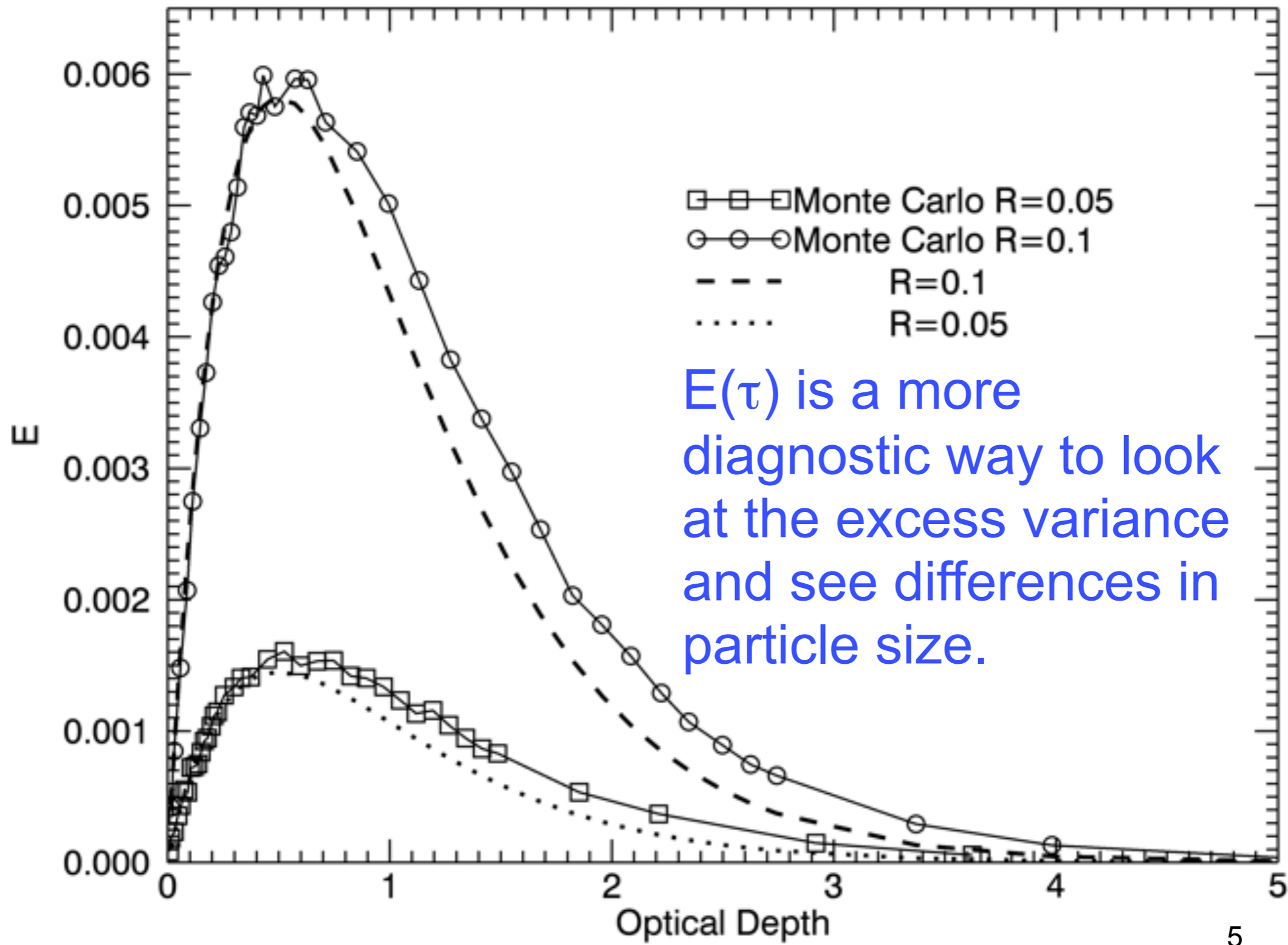
$\Delta\sigma^2$ =excess variance

$$E = \exp\left[\frac{-2\tau}{\mu} + \frac{\tau}{\mu} \frac{\pi R_{eff}^2}{\mu A}\right] - e^{-2\tau/\mu}$$

# Dependence of R on E

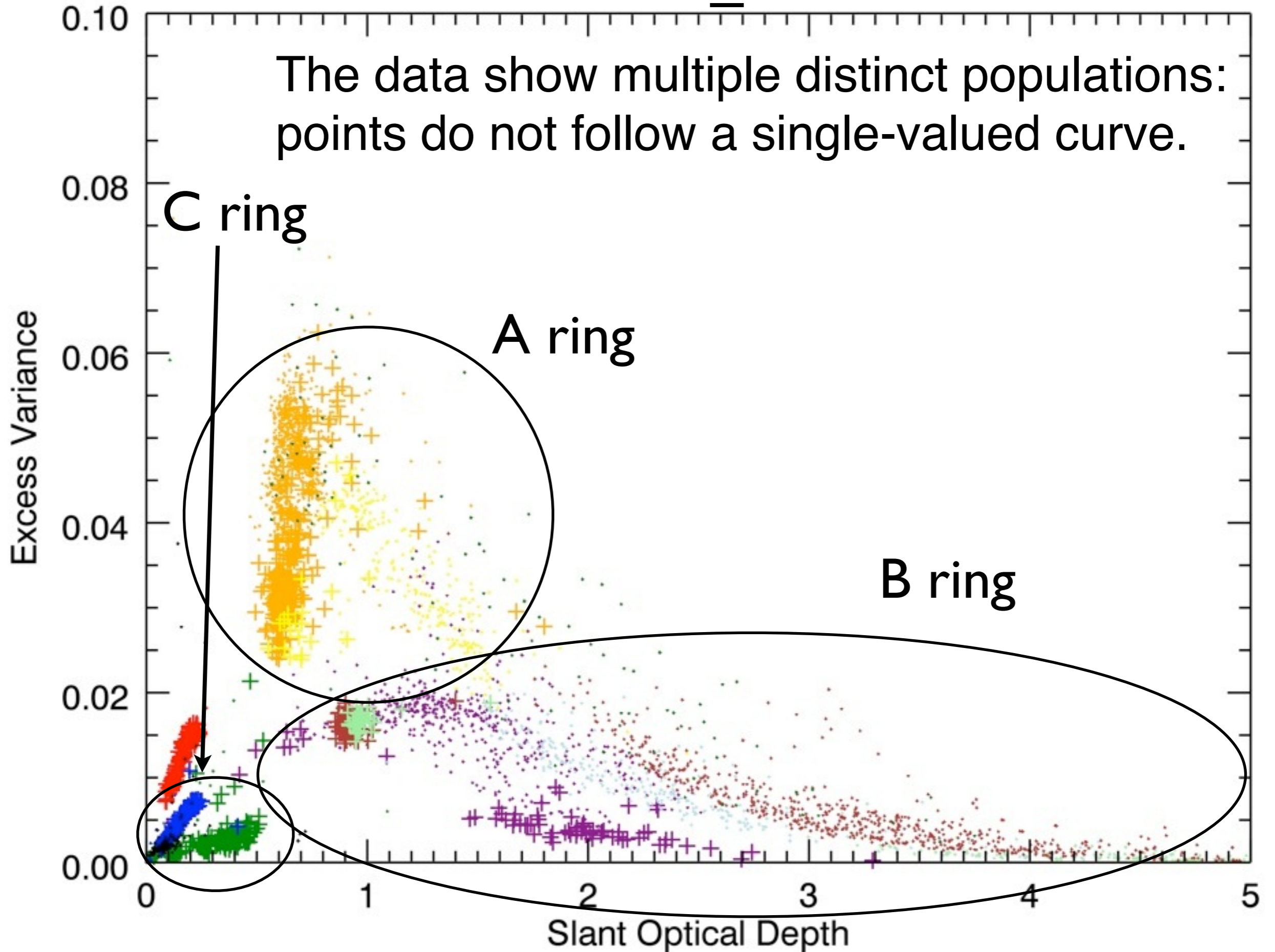


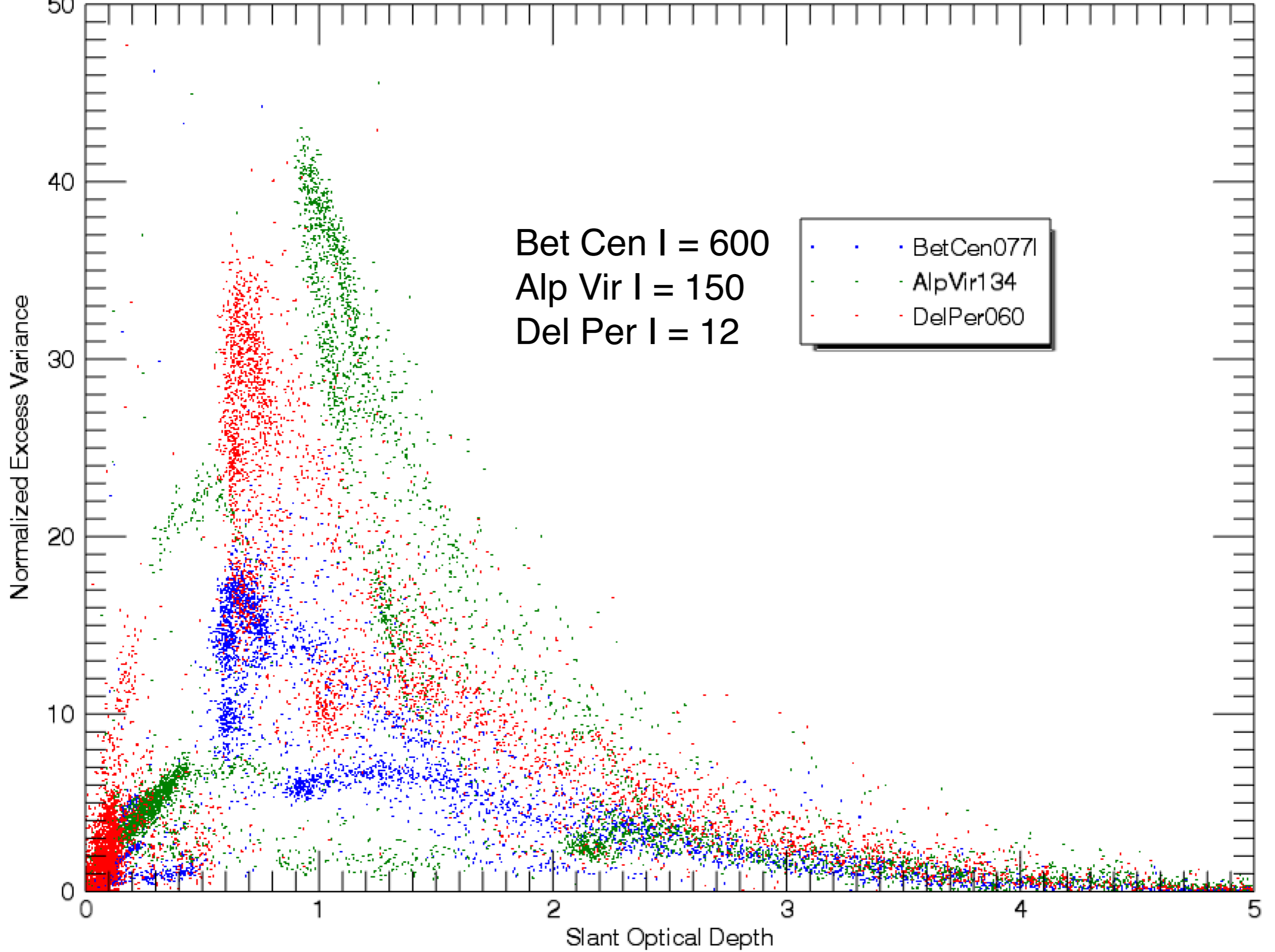
# Excess Variance Dependence on Optical Depth



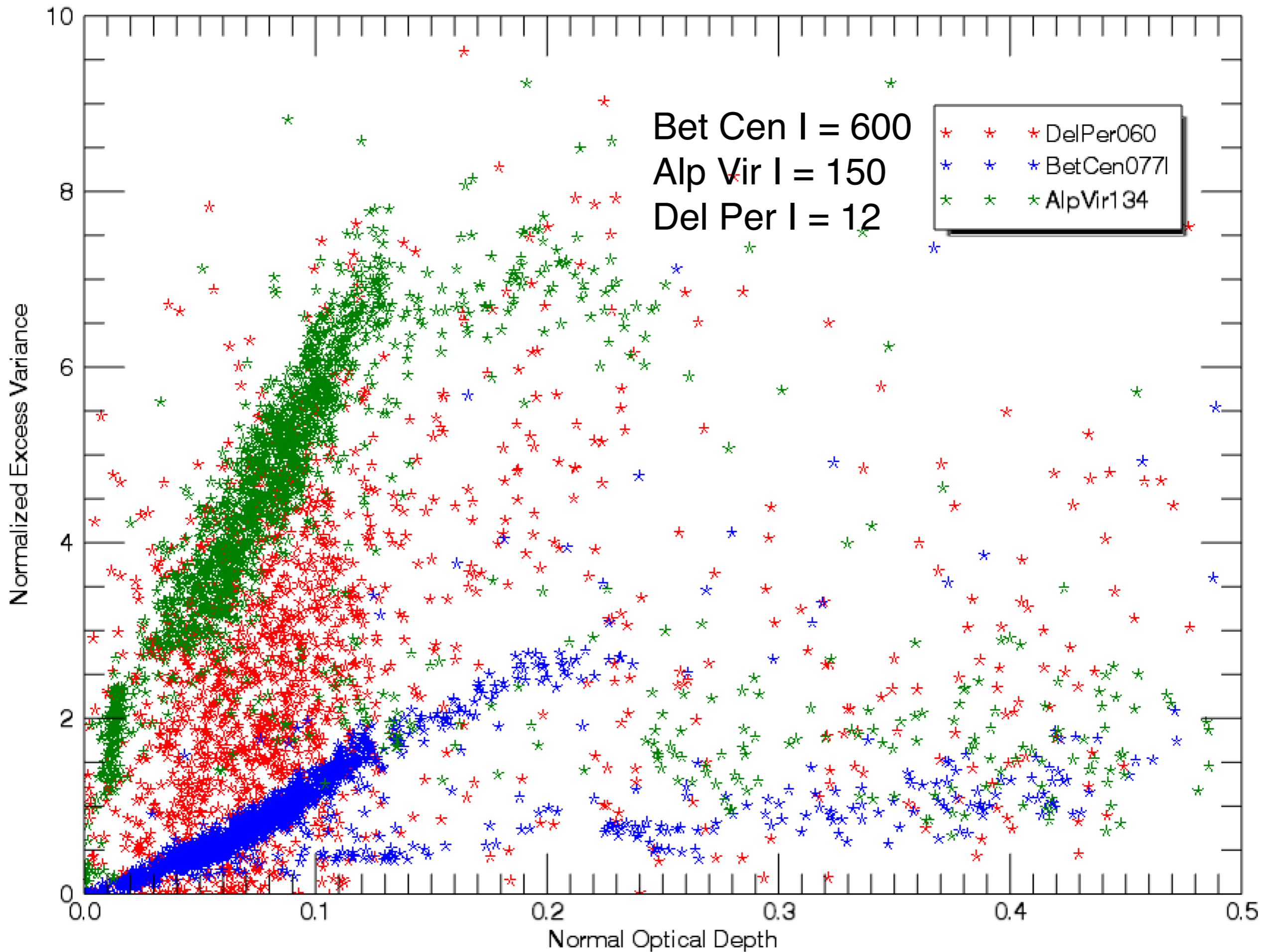
# BetCen77\_I

The data show multiple distinct populations: points do not follow a single-valued curve.





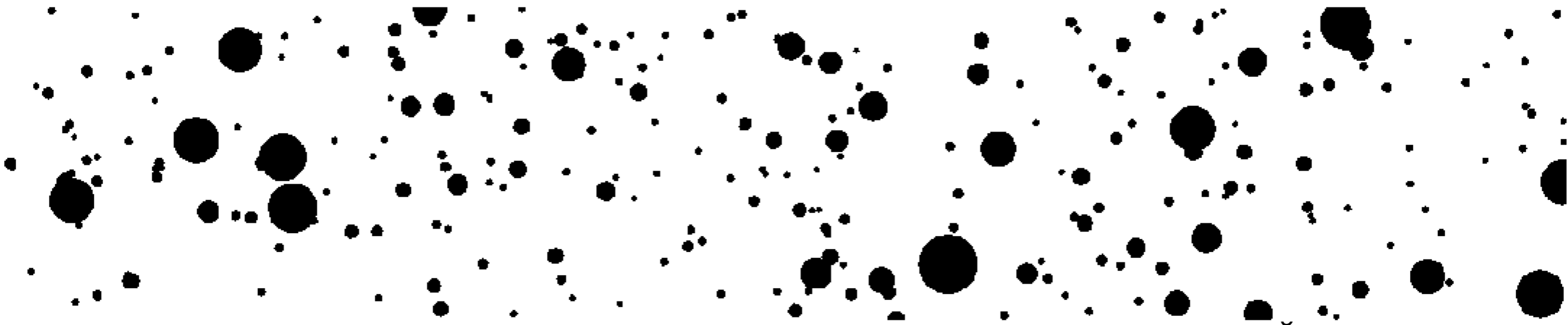
# C Ring Comparison



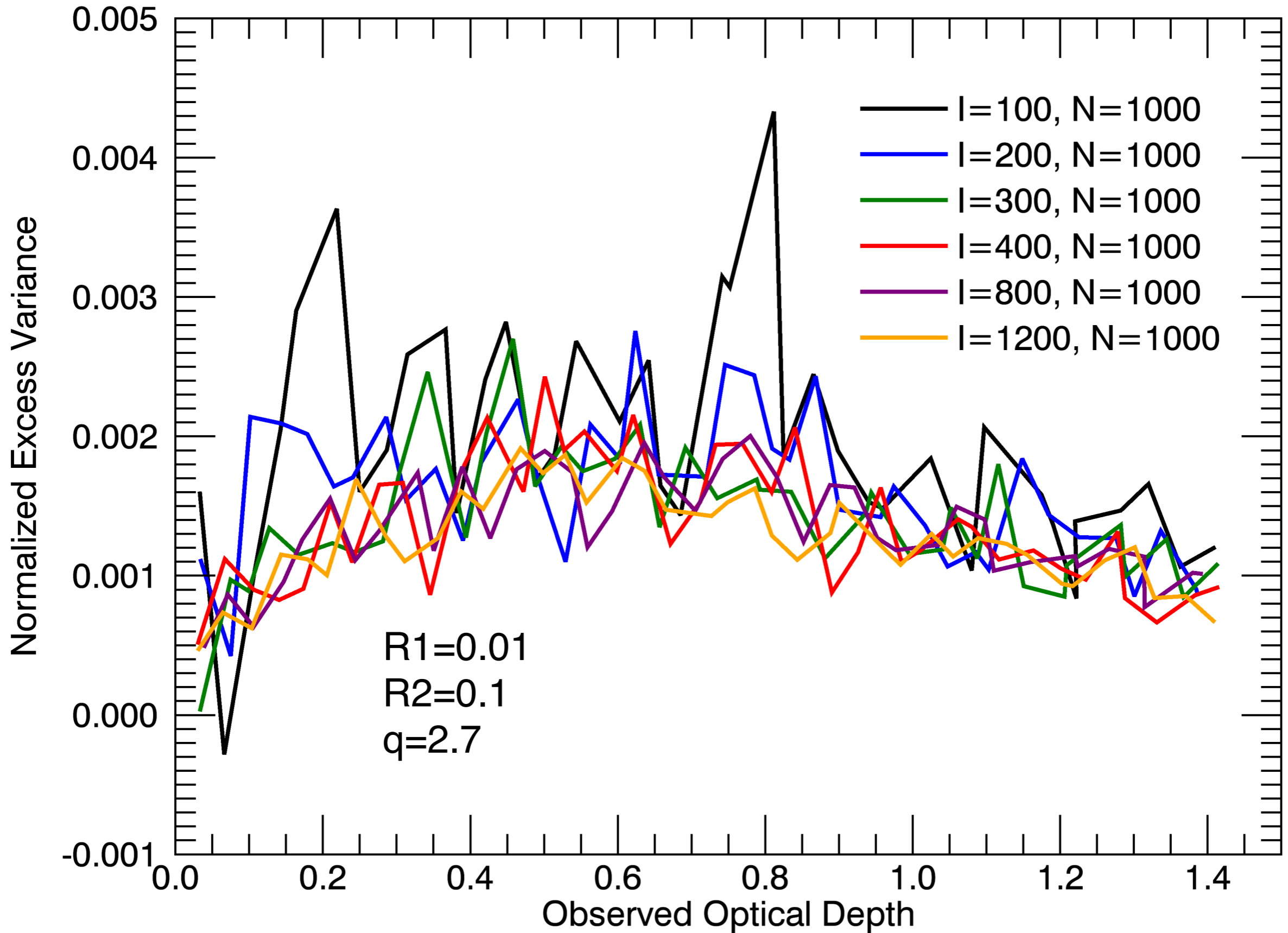


# Simulating Actual Occultations

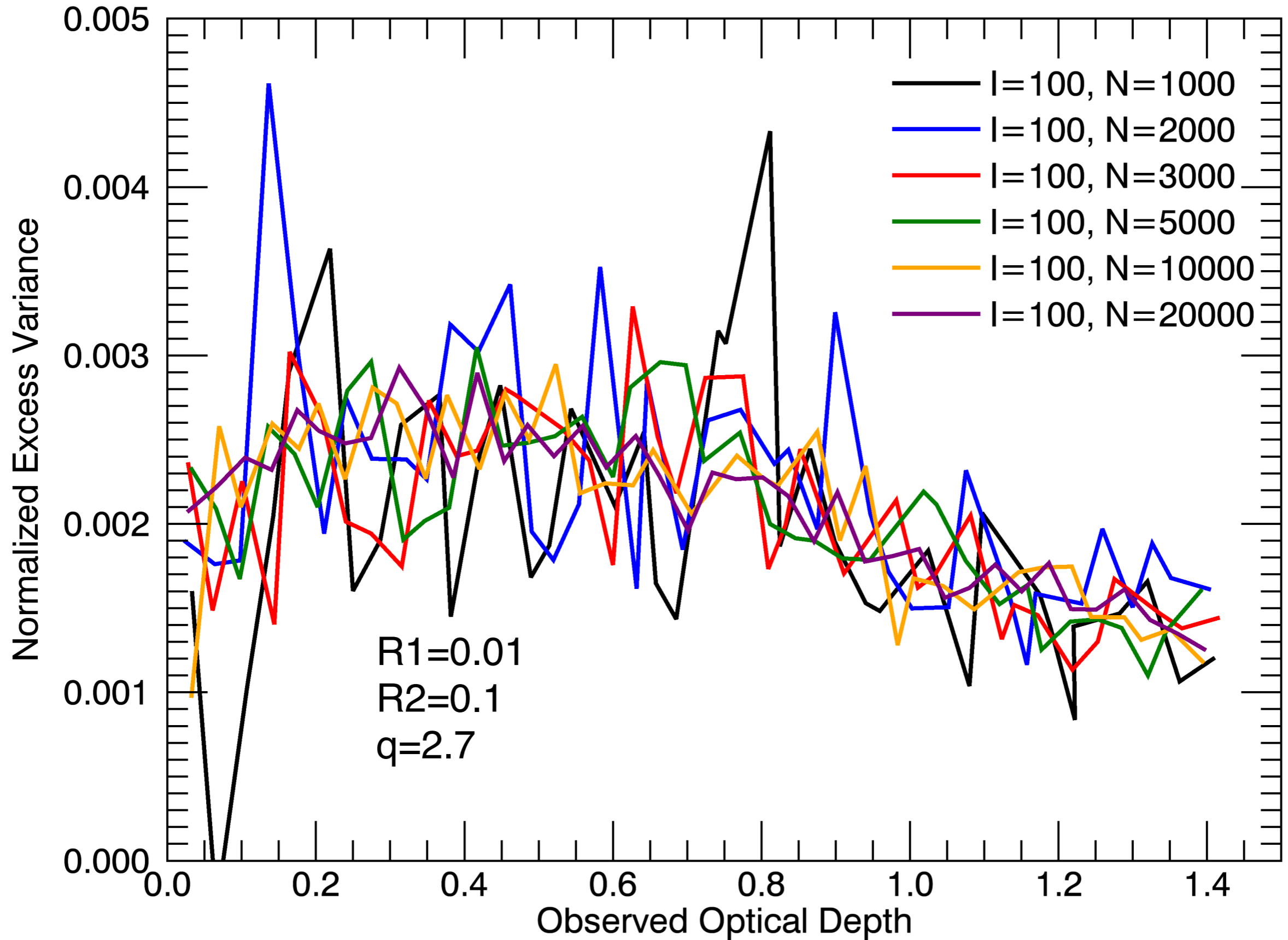
- UVIS measured occultation counts vary by  $\sim 100x$ , from a few counts per ms to several 100 counts/ms.
- Radial resolution  $\sim 10$  m: 1000 pts/10km.
- Check Monte Carlo simulations with different star brightness, radial binning, and power-law particle size distributions.



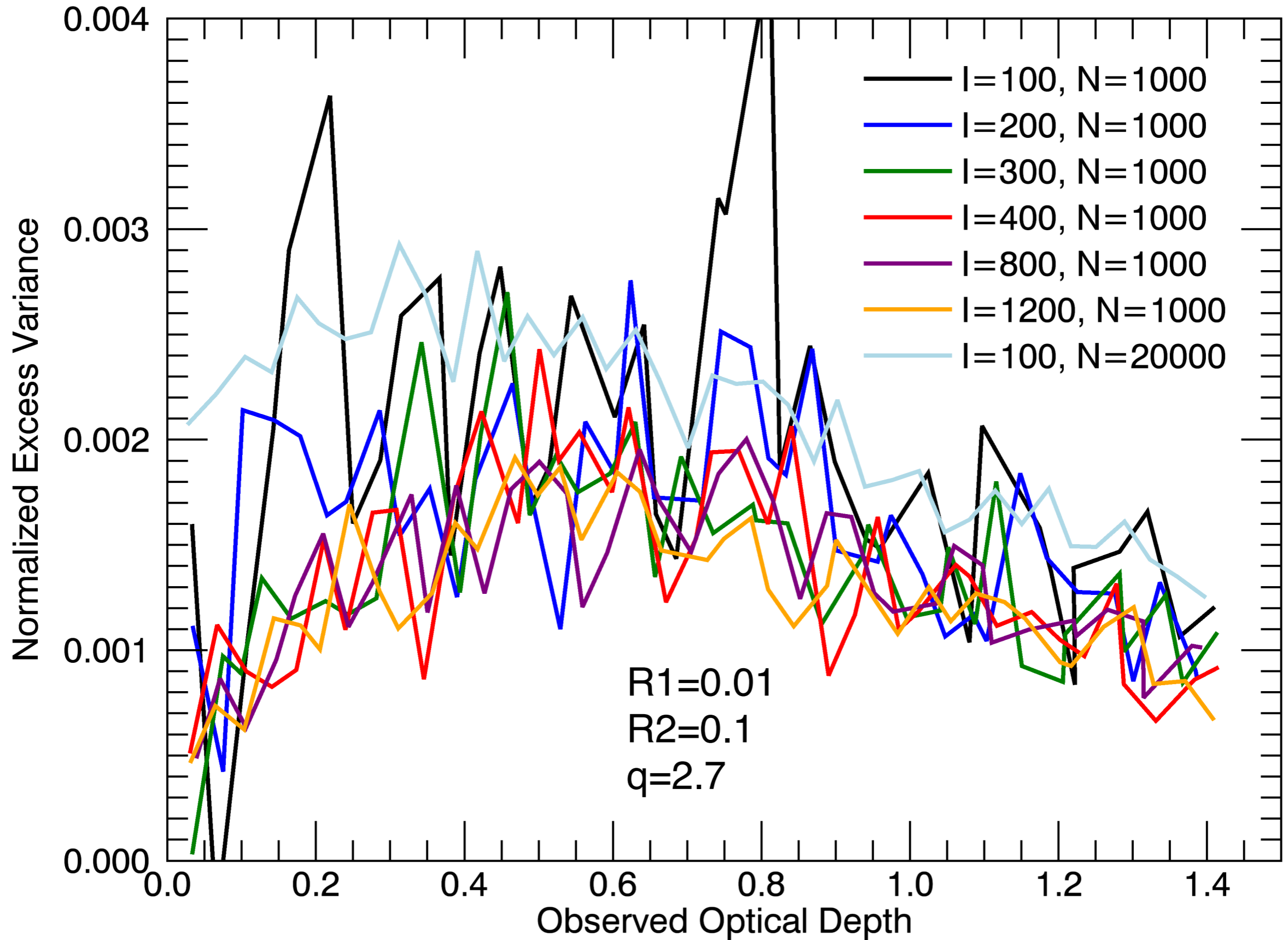
# Star Signal Comparison ( $l$ = number of photons, unocculted)

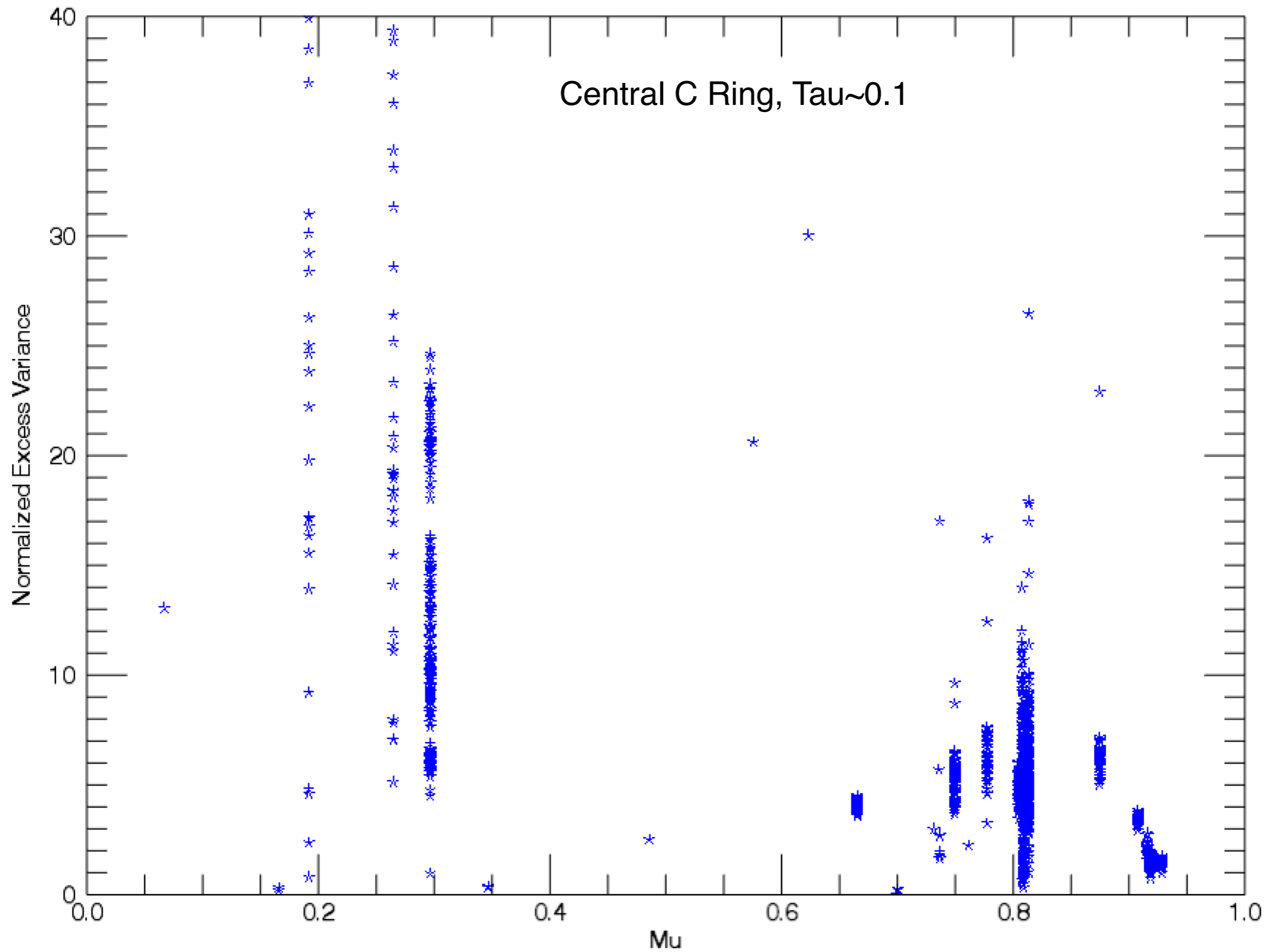


# Bin Size Comparison (N = number of measurements used)



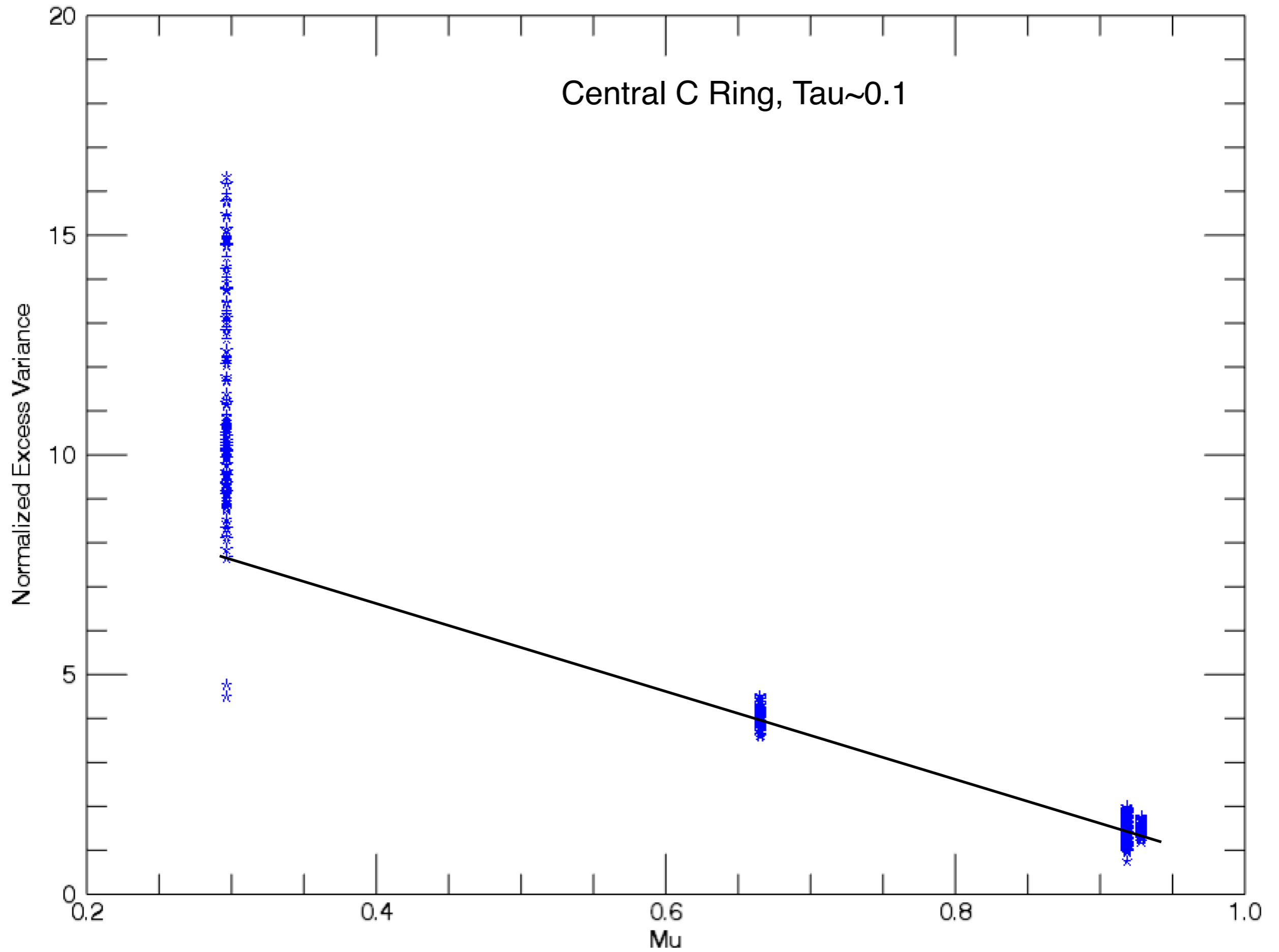
# Increasing Bin Size not the same as Increasing Star Brightness

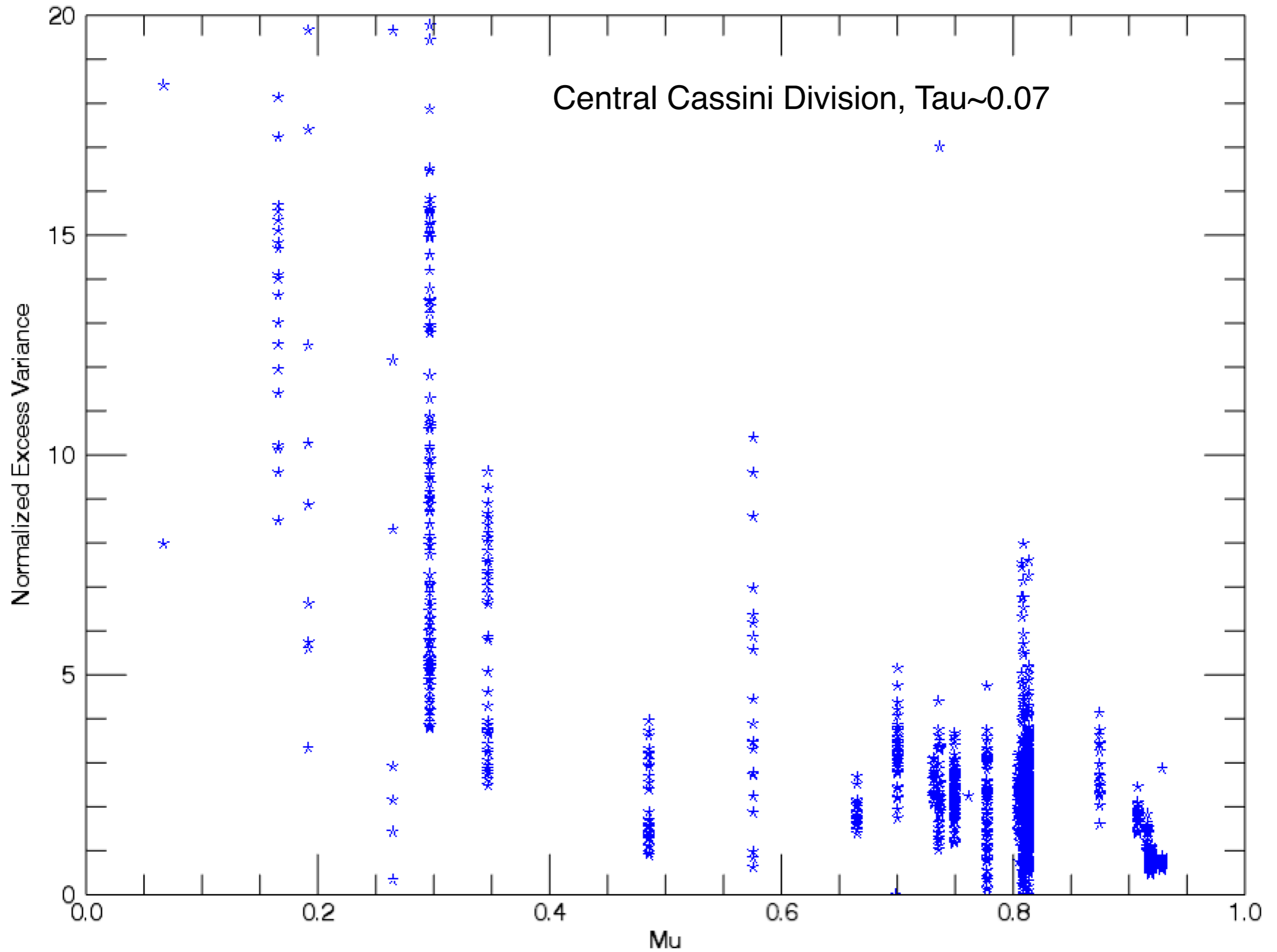




84000-84400 km Stars with  $l > 300$  Only

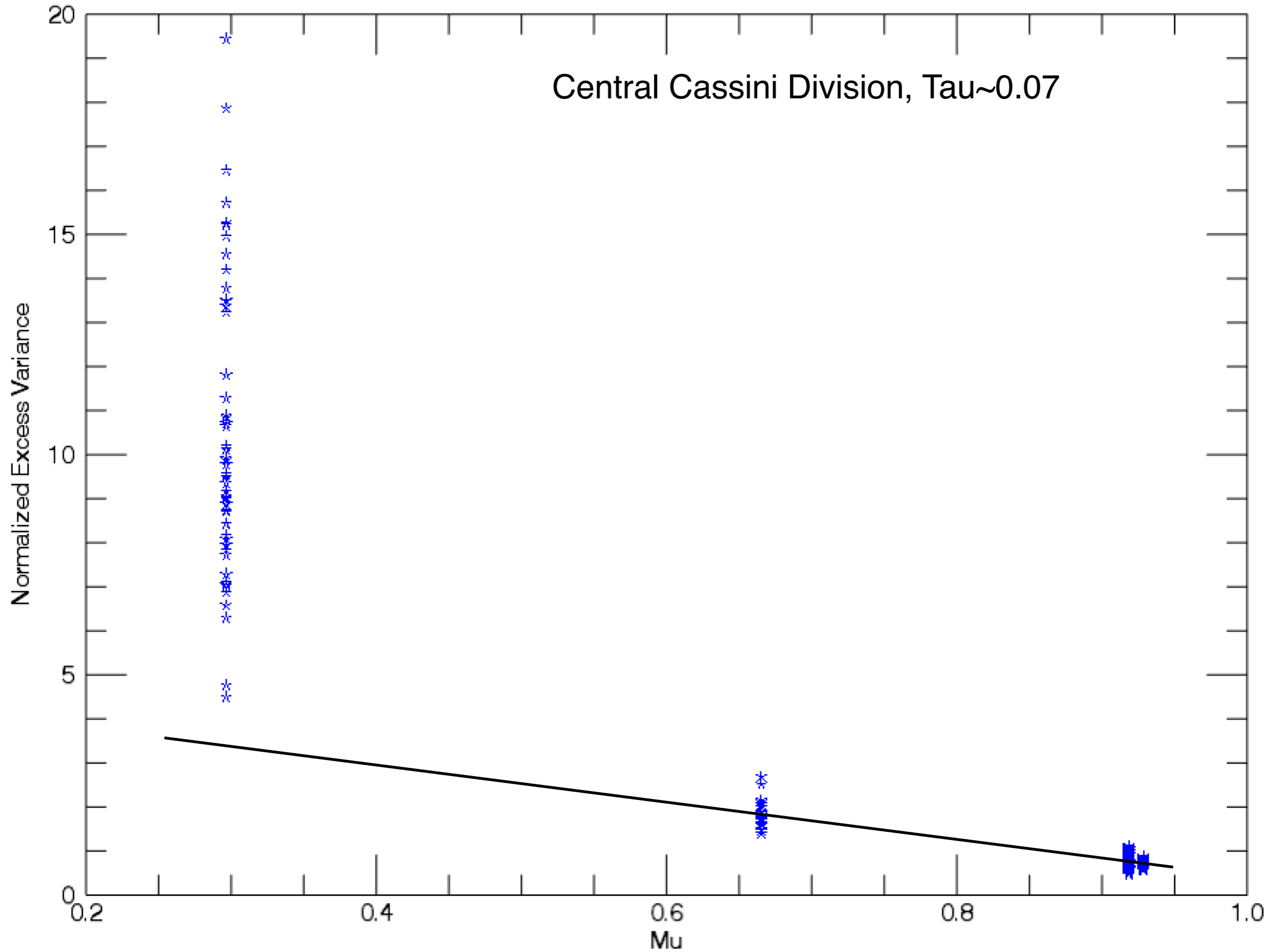
Central C Ring,  $\tau \sim 0.1$



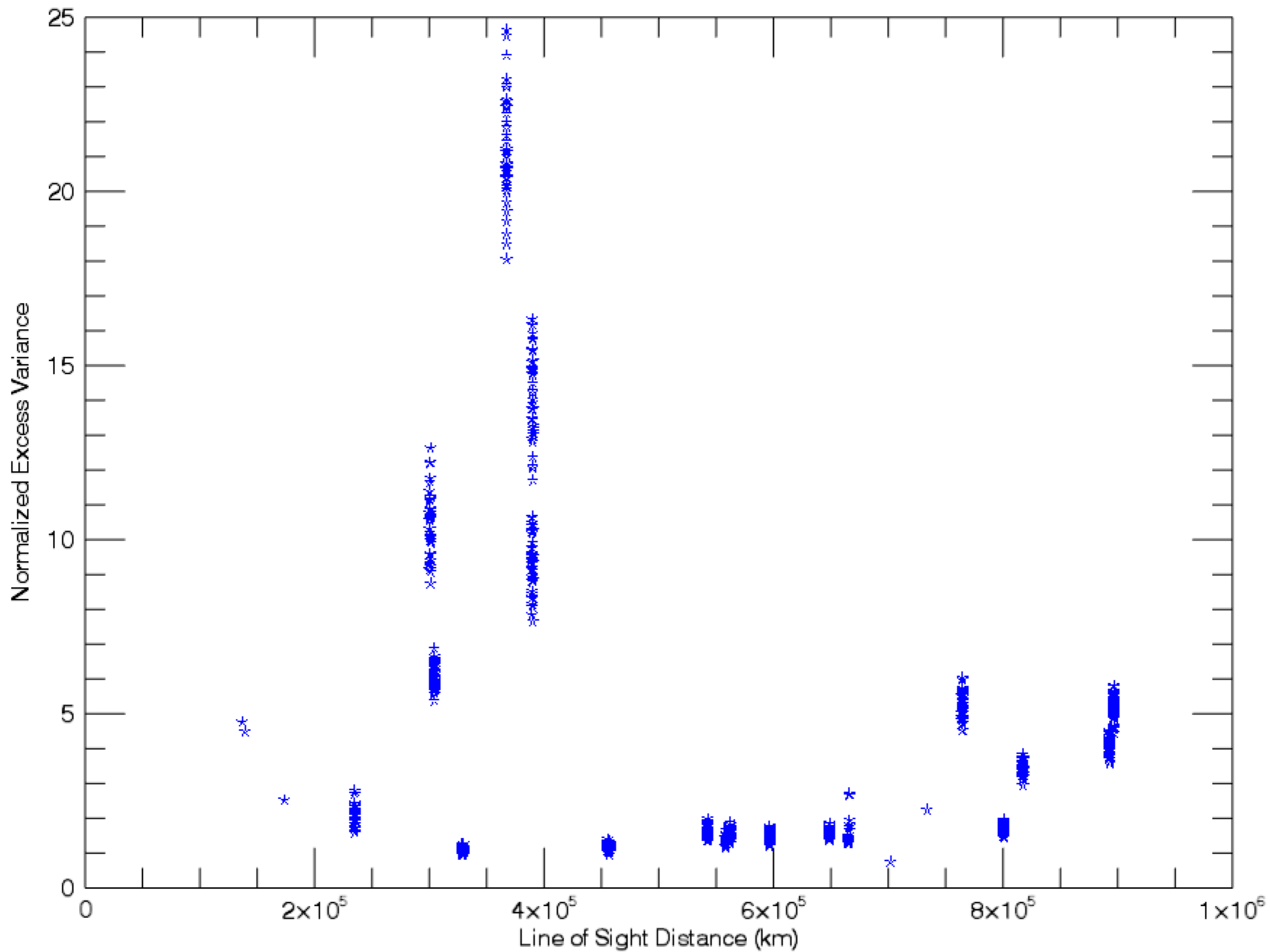


118650-118850 km Stars with  $l > 300$  Only

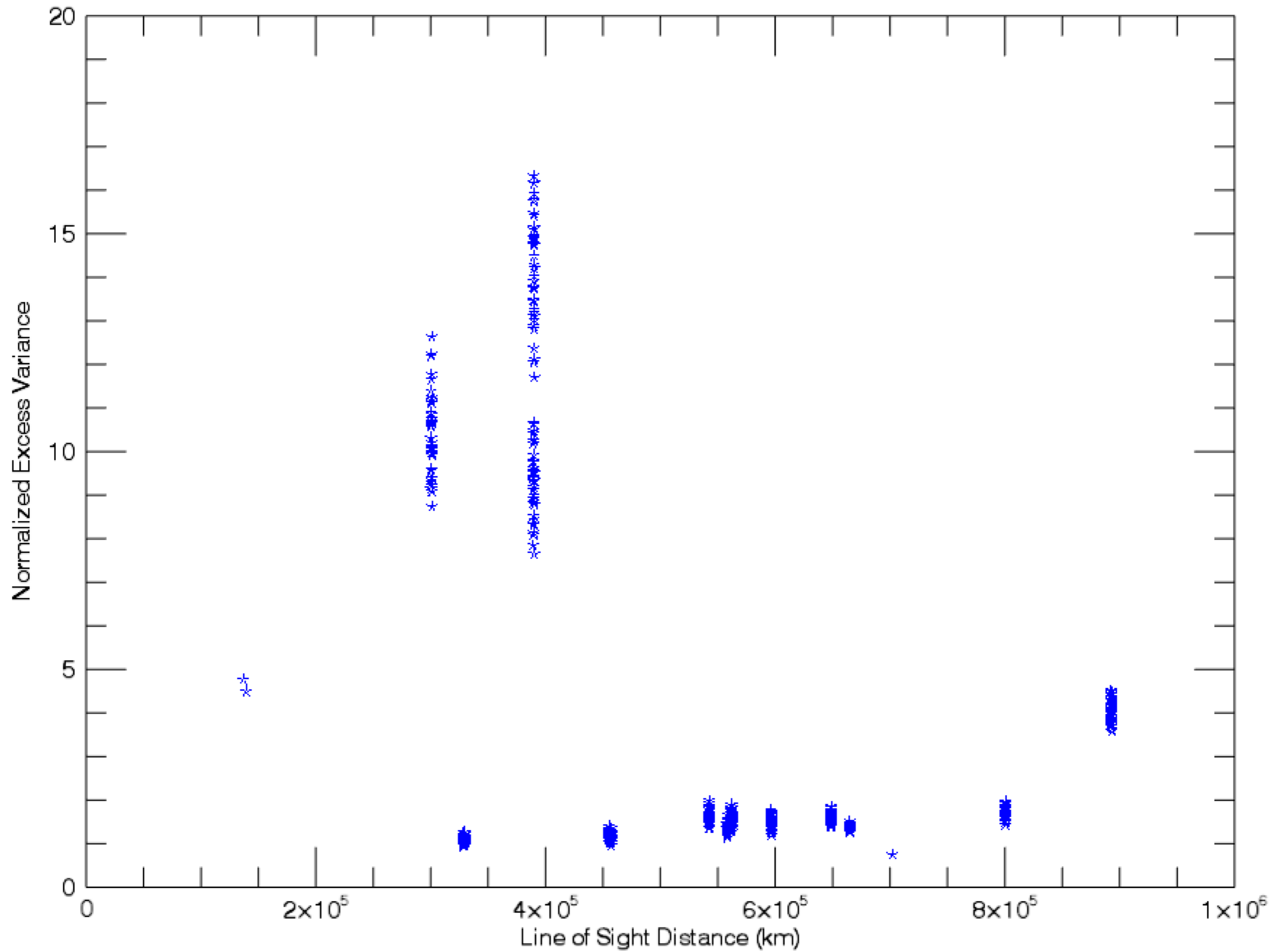
Central Cassini Division,  $\tau \sim 0.07$



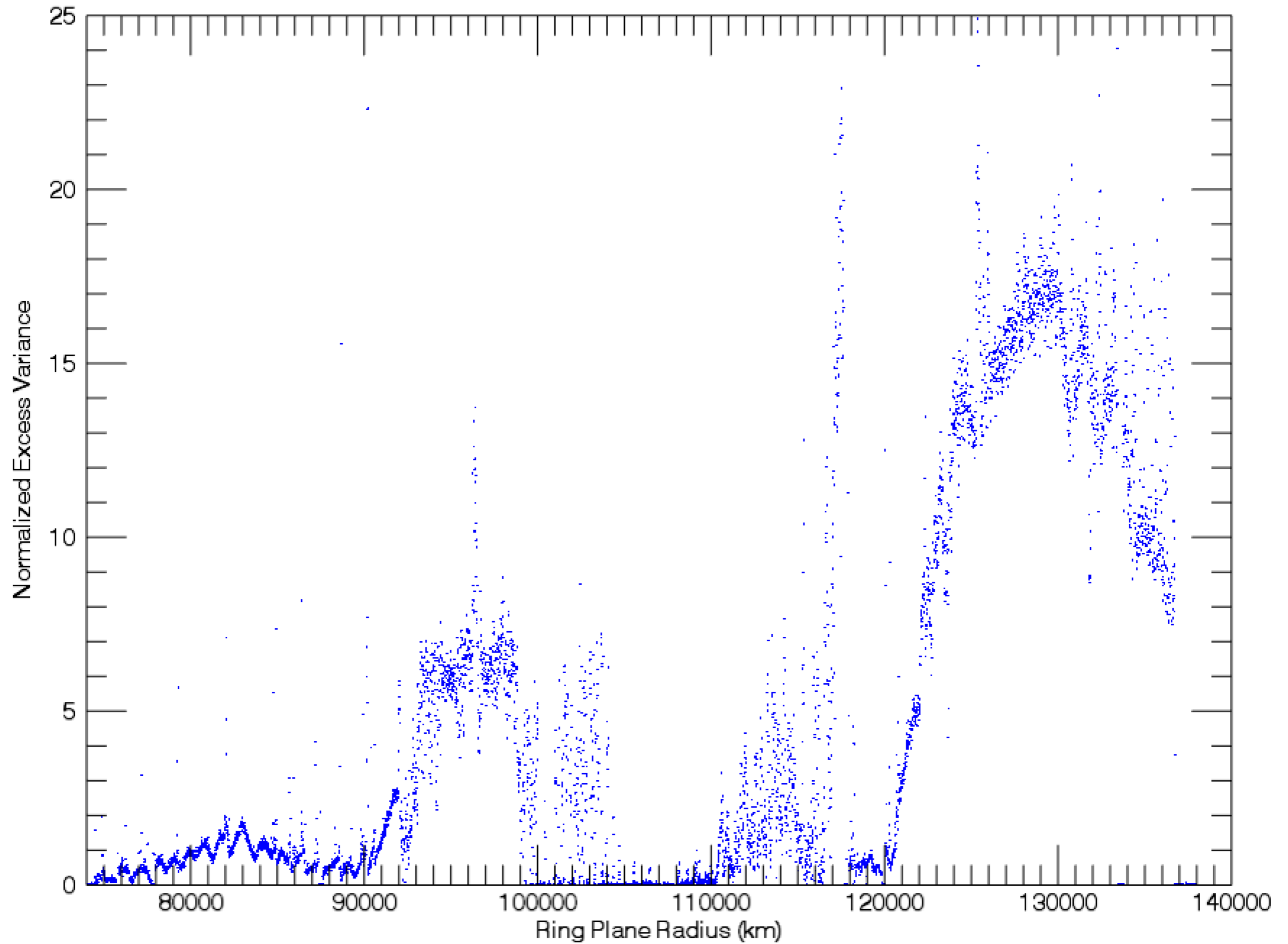


84000-84400 km Stars with  $I > 100$  Only

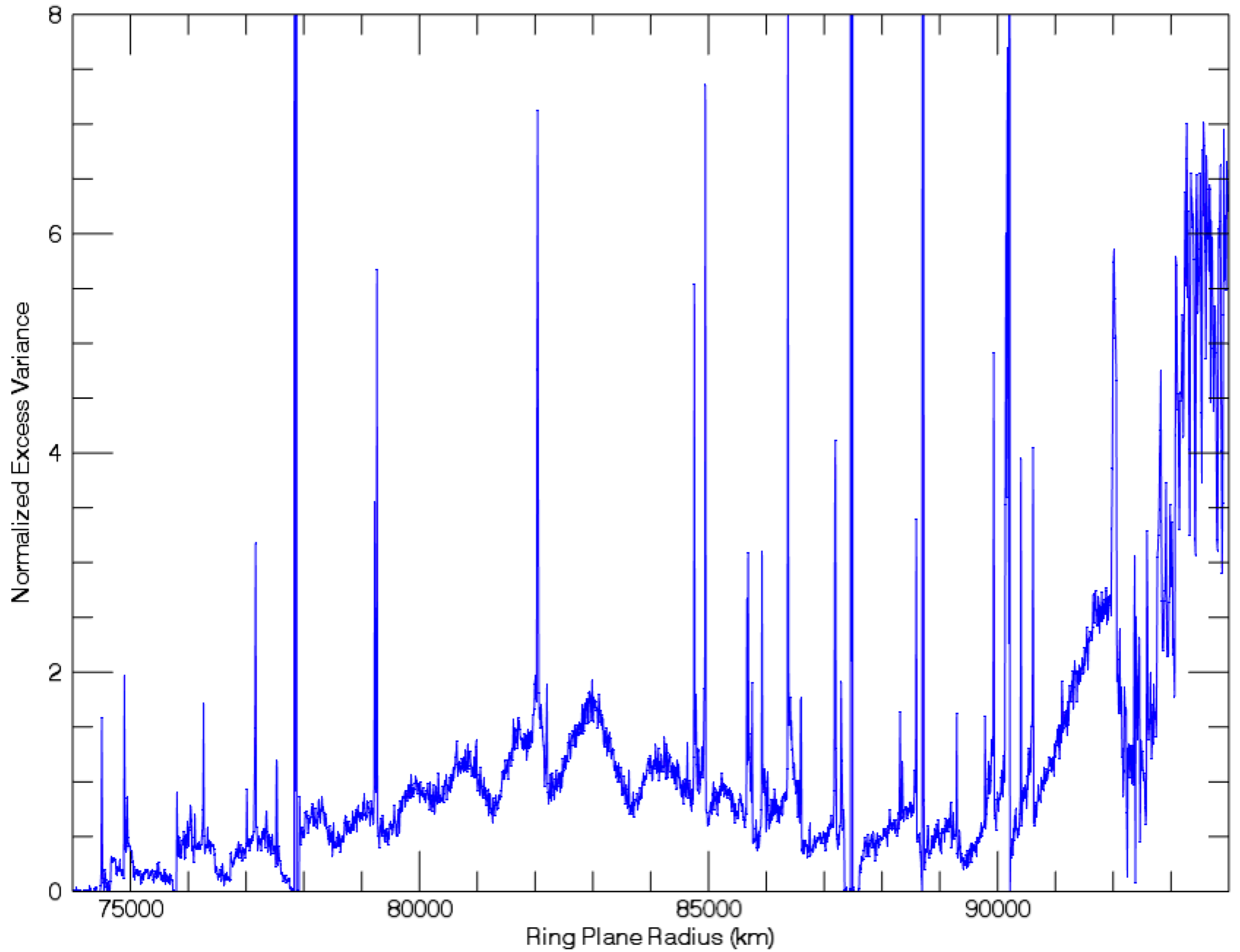
84000-84400 km Stars with  $l > 300$  Only



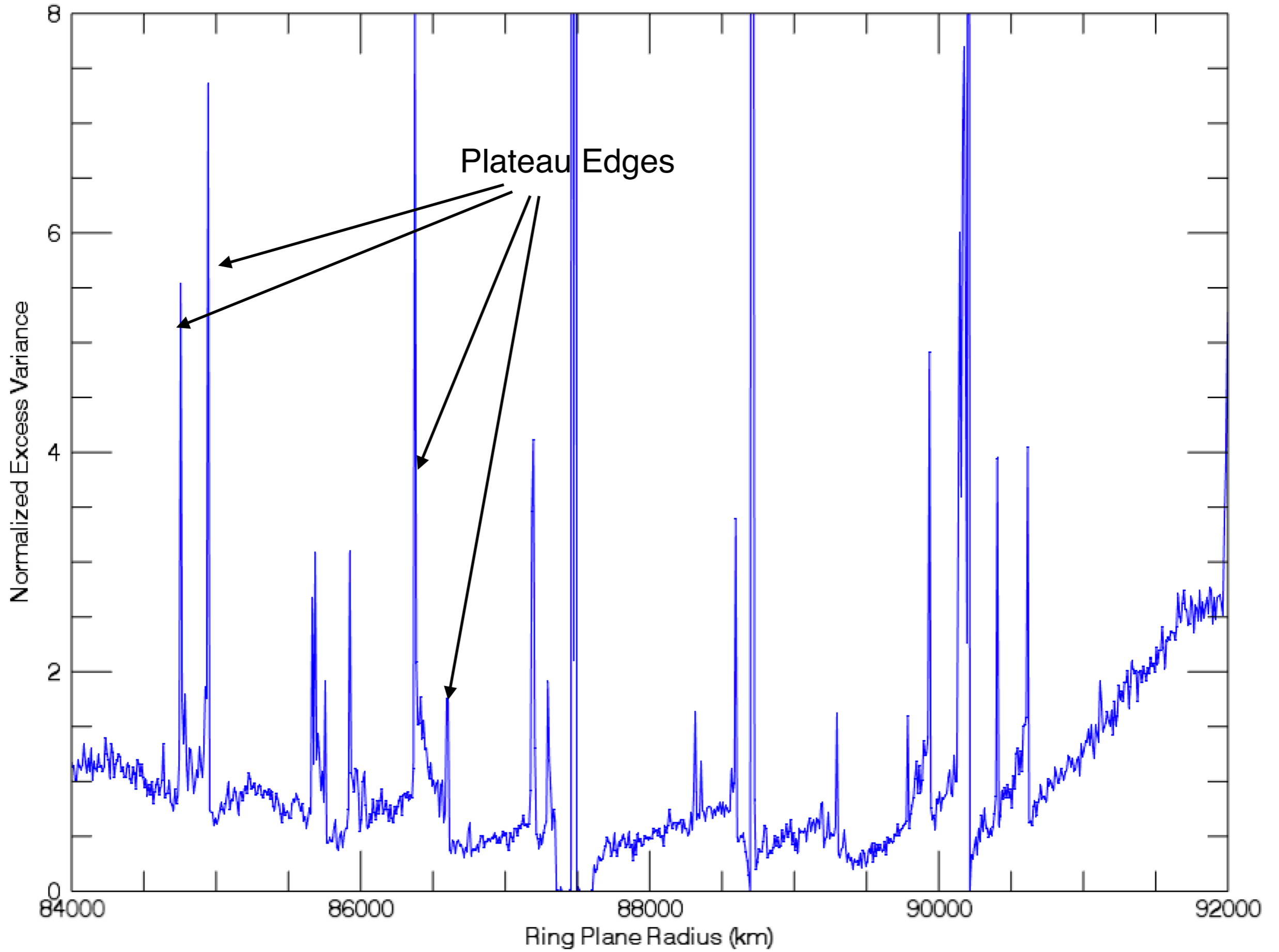
BetCen0771

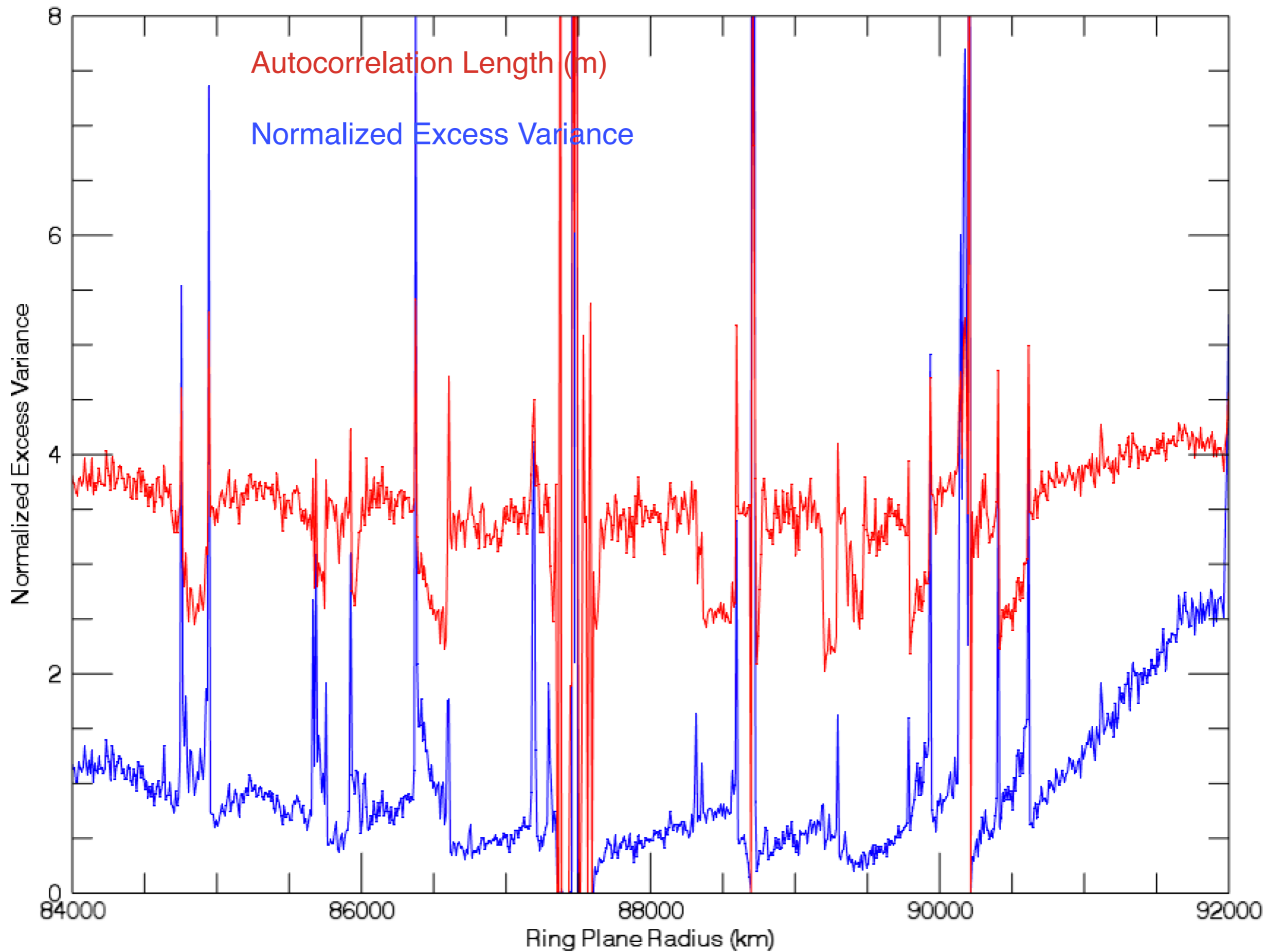


BetCen0771



BetCen0771





# Conclusions

- Multitude of occultations is great, but what is it telling us? Derived length scales do not always agree between occultations.
- Star brightness matters.
- Excess variance in the C ring plateaus is the same as in the main C ring: “mean” particle size smaller in plateaus.
- Working on extracting information on three-dimensional ring structure information from excess variance.