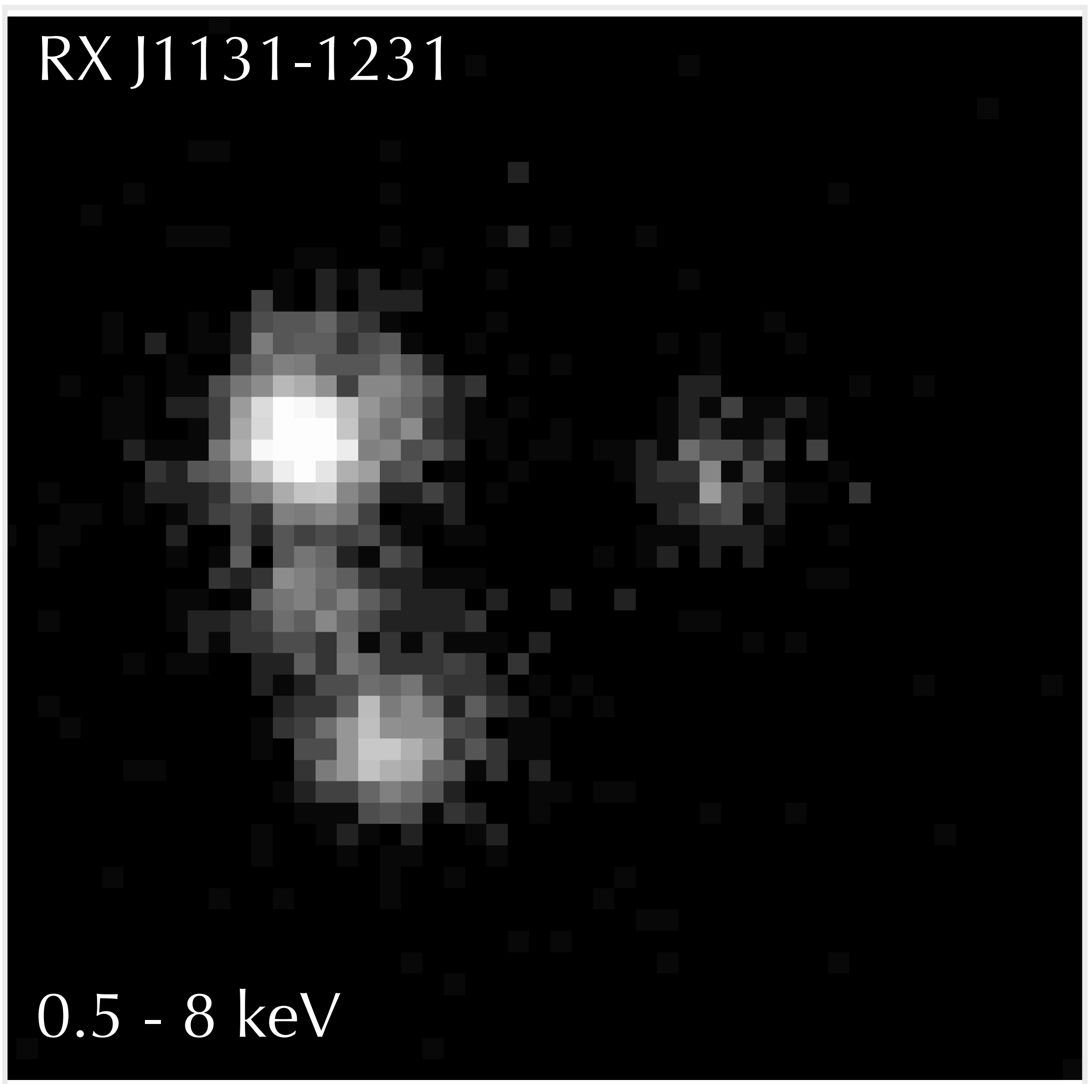
Dark Matter Determinations from *Chandra* Observations of Quadruply Lensed Quasars



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- Microlensing by stars causes discrepancies with lens models.

- X-rays give cleanest microlensing signal.

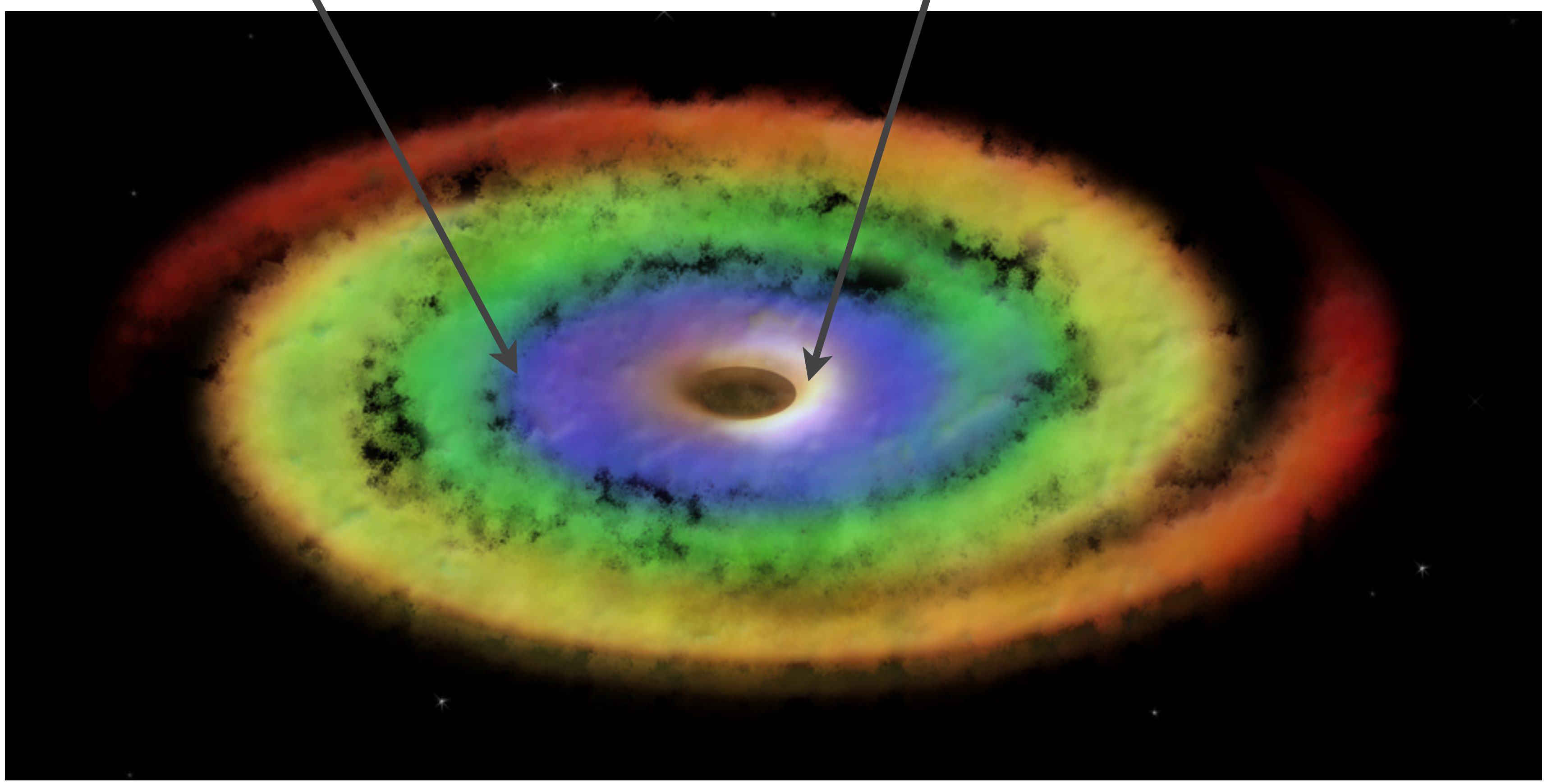
- Ratio of dark matter to stellar material determines probability of strong microlensing effects.

- Ensemble of 14 systems indicates the integrated mass through galaxy at $R \approx 5$ kpc is 85% – 95% dark matter.

X-rays give cleanest microlensing signal

Optical region: few × 10^{-7} arcsec

X-ray region: few × 10^{-9} arcsec



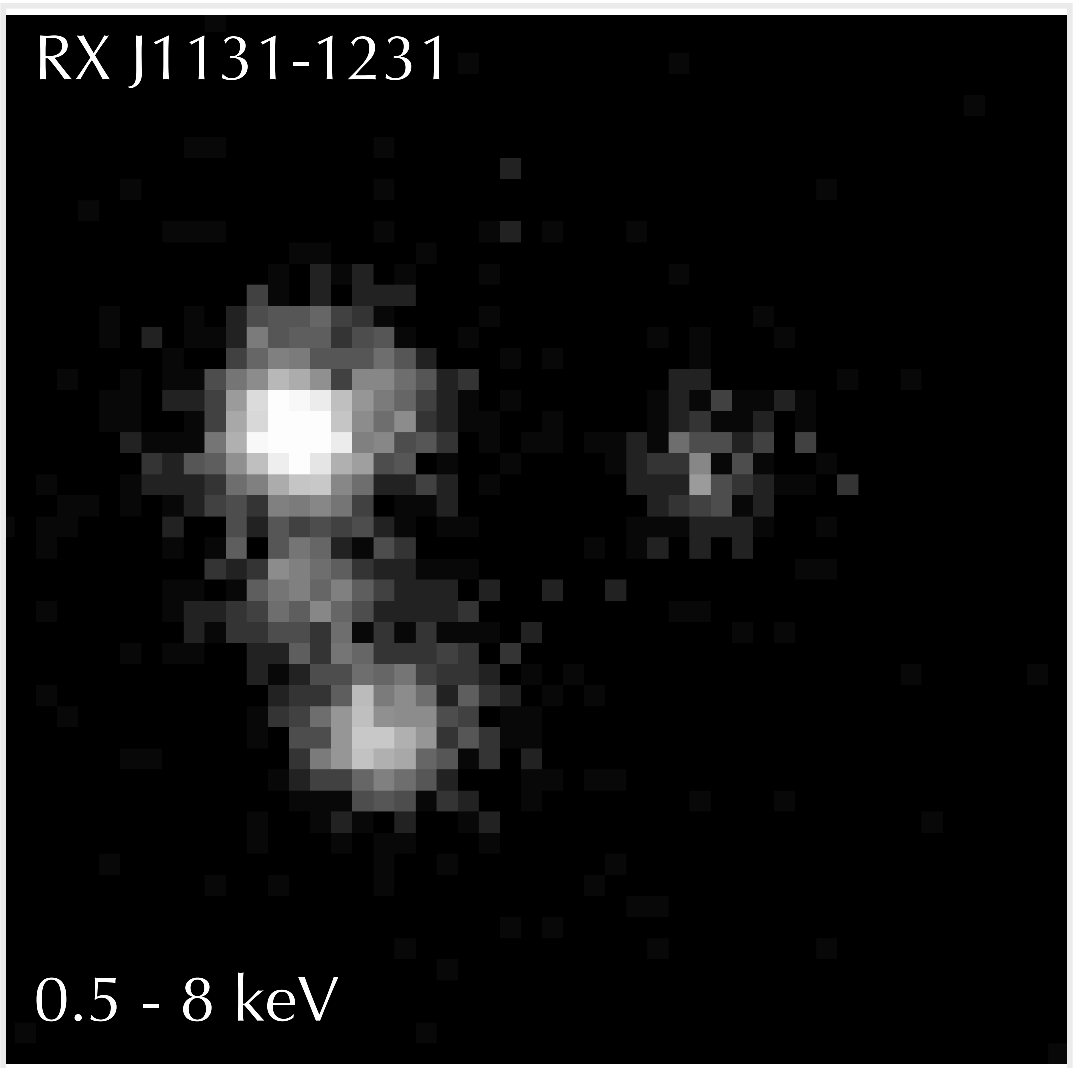
Schematic of quasar accretion disk

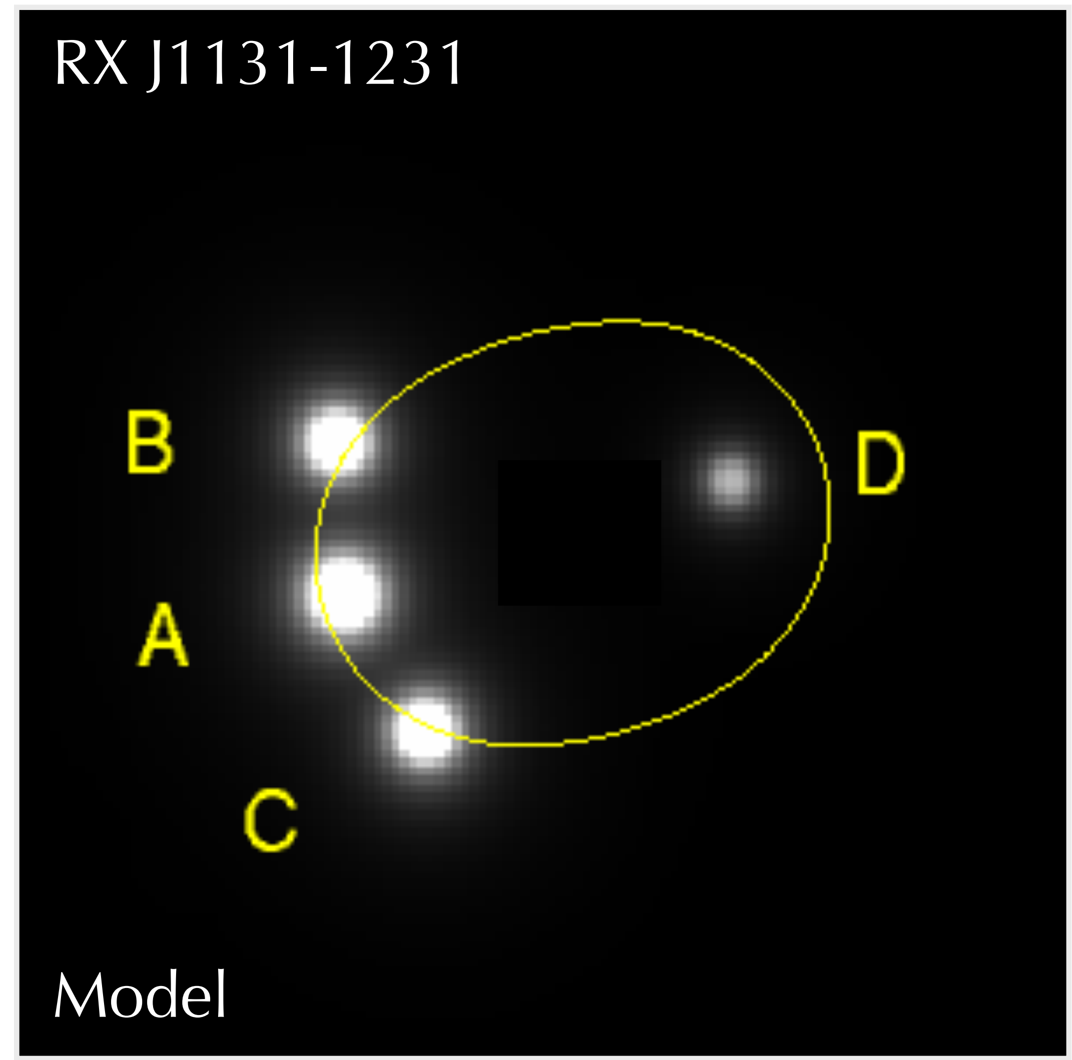
Einstein radius of star in typical lensing galaxy:

$\sim 3\,\sqrt{(m/M_\odot)} \times 10^{-6}$ arcsec

Strong microlensing effects are observed

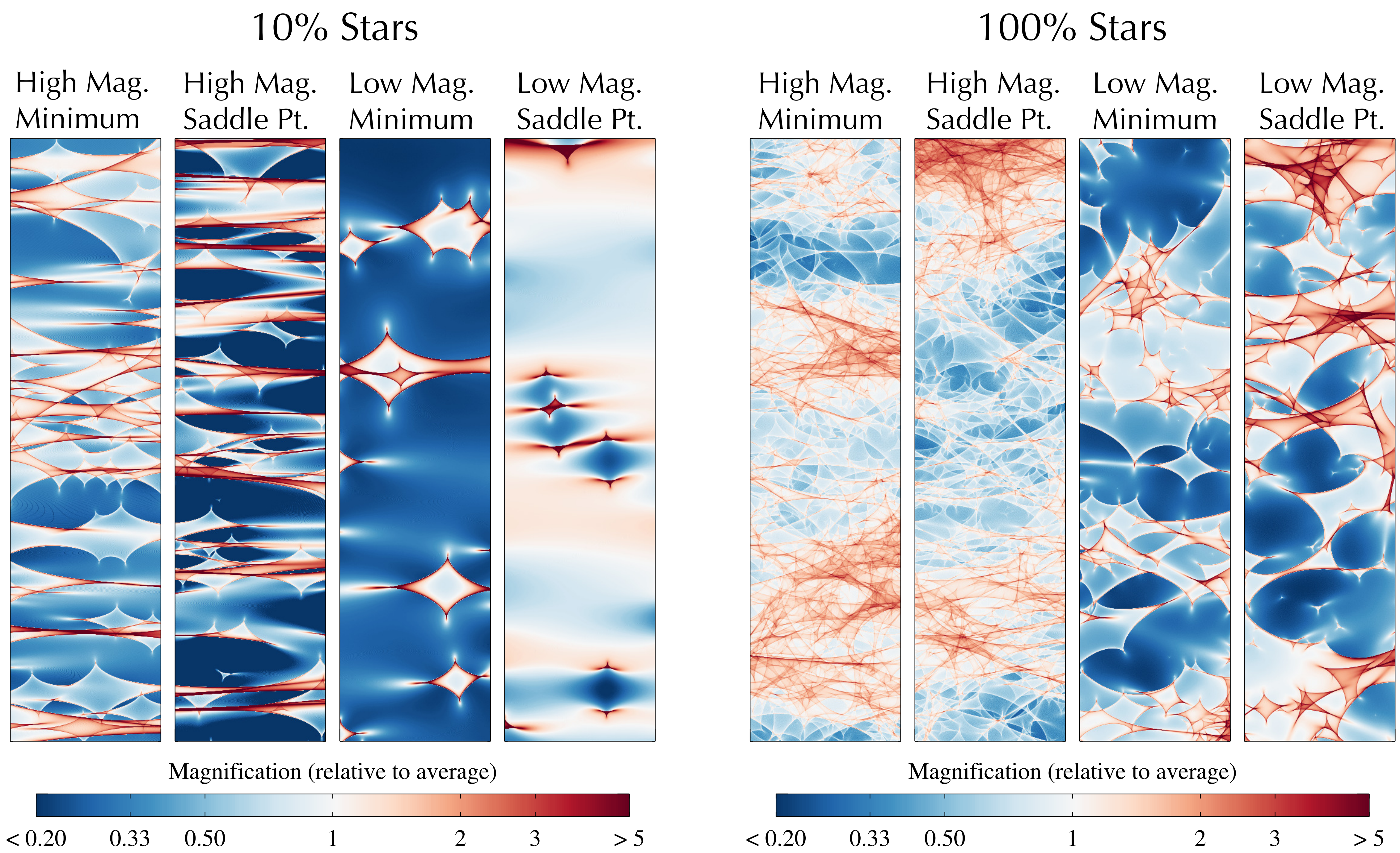
High magnification saddle point image (A) is strongly demagnified in X-rays w.r.t. model





Probability of microlensing depends on dark/stellar ratio

Custom microlensing maps are made for each system for a variety of dark/stellar ratios.
Strong demagnifications are unlikely for very high (100%) and very low (1%) stellar fractions.



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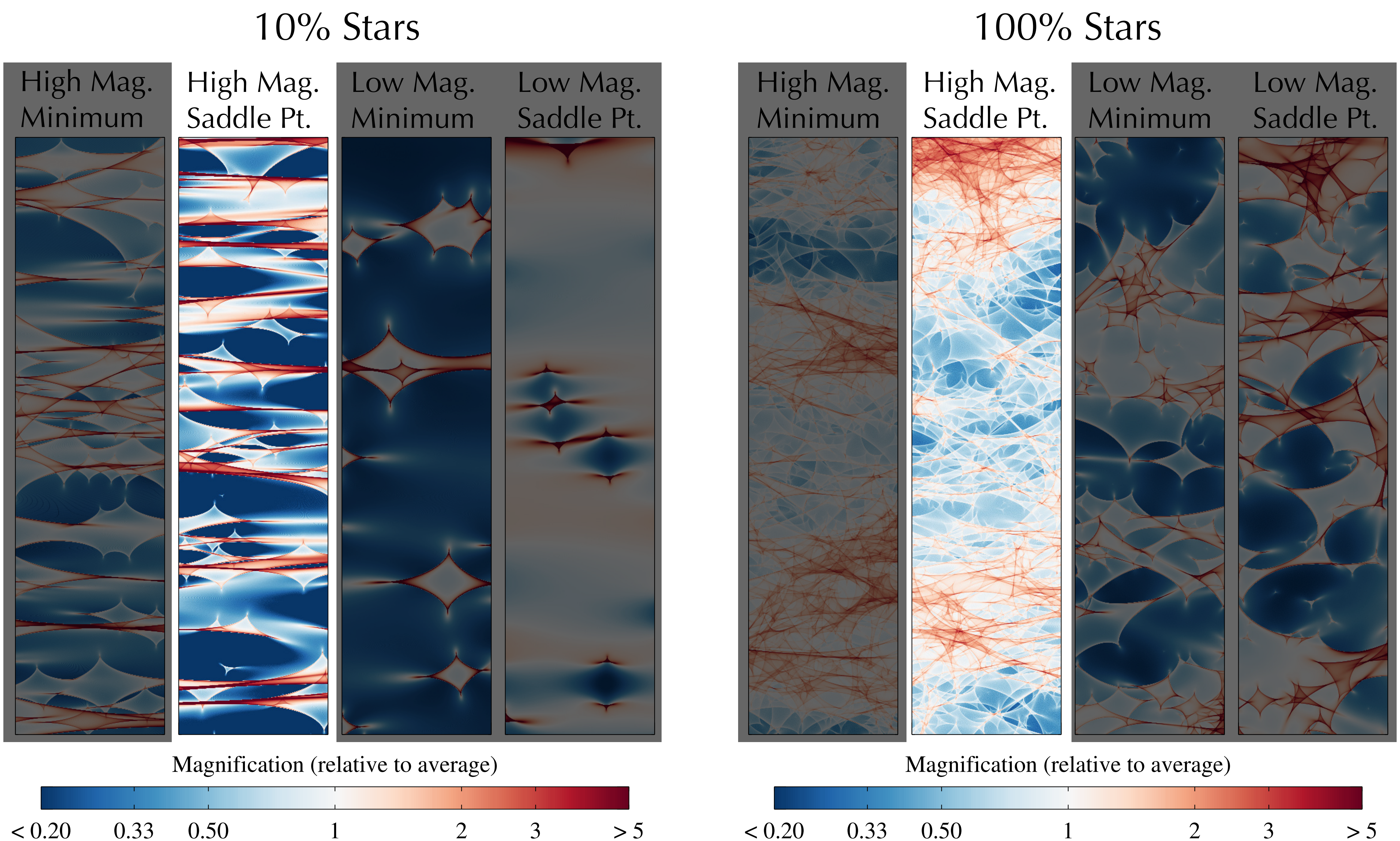
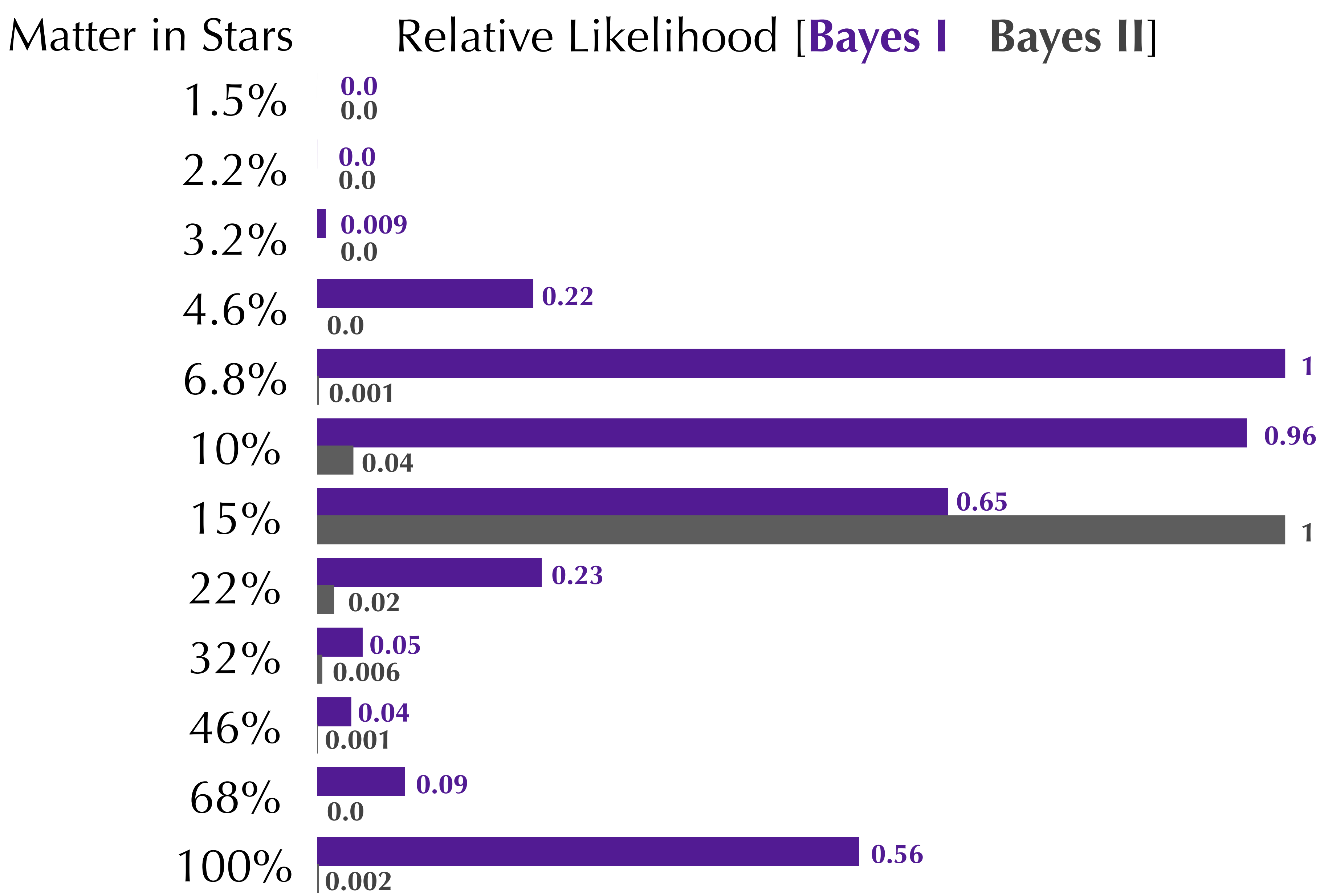


Ensemble of quads indicates 85–95% dark matter at $R \approx 5$ kpc

Two Bayesian methods are used to determine most likely dark/stellar ratio.
Integrated matter fraction through lensing galaxies at impact parameters between 2 – 8 kpc



- Cleanest microlensing signal in X-rays
- Strength of microlensing effects depends on composition of matter
- Independent evidence for existence of dark matter
- 85 – 95% dark matter at ~5 kpc from galaxy center

Questions? davepooley@me.com