AMPM

Asteroid-Mass Primordial Black Hole Microlensing

Renee Key
Swinburne University of Technology, Melbourne Australia
with Ken Freeman, Alan Duffy, Edward Taylor, Anais Moller

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AMPM (DECam)

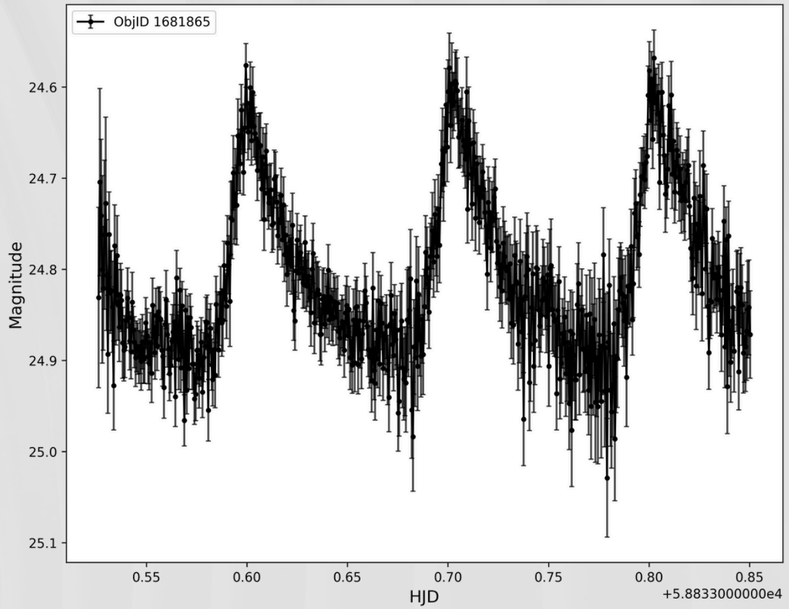
LMC (50kpc)

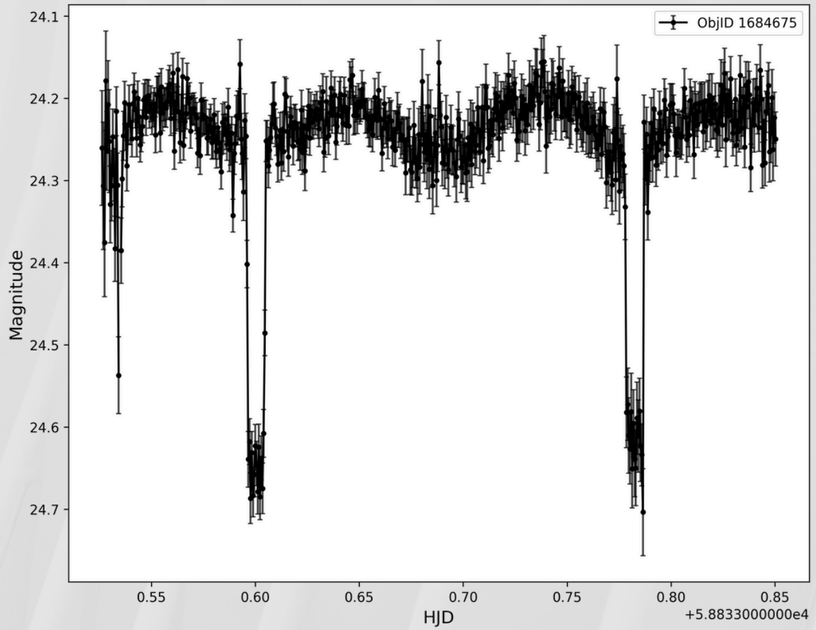
500,000+ stars

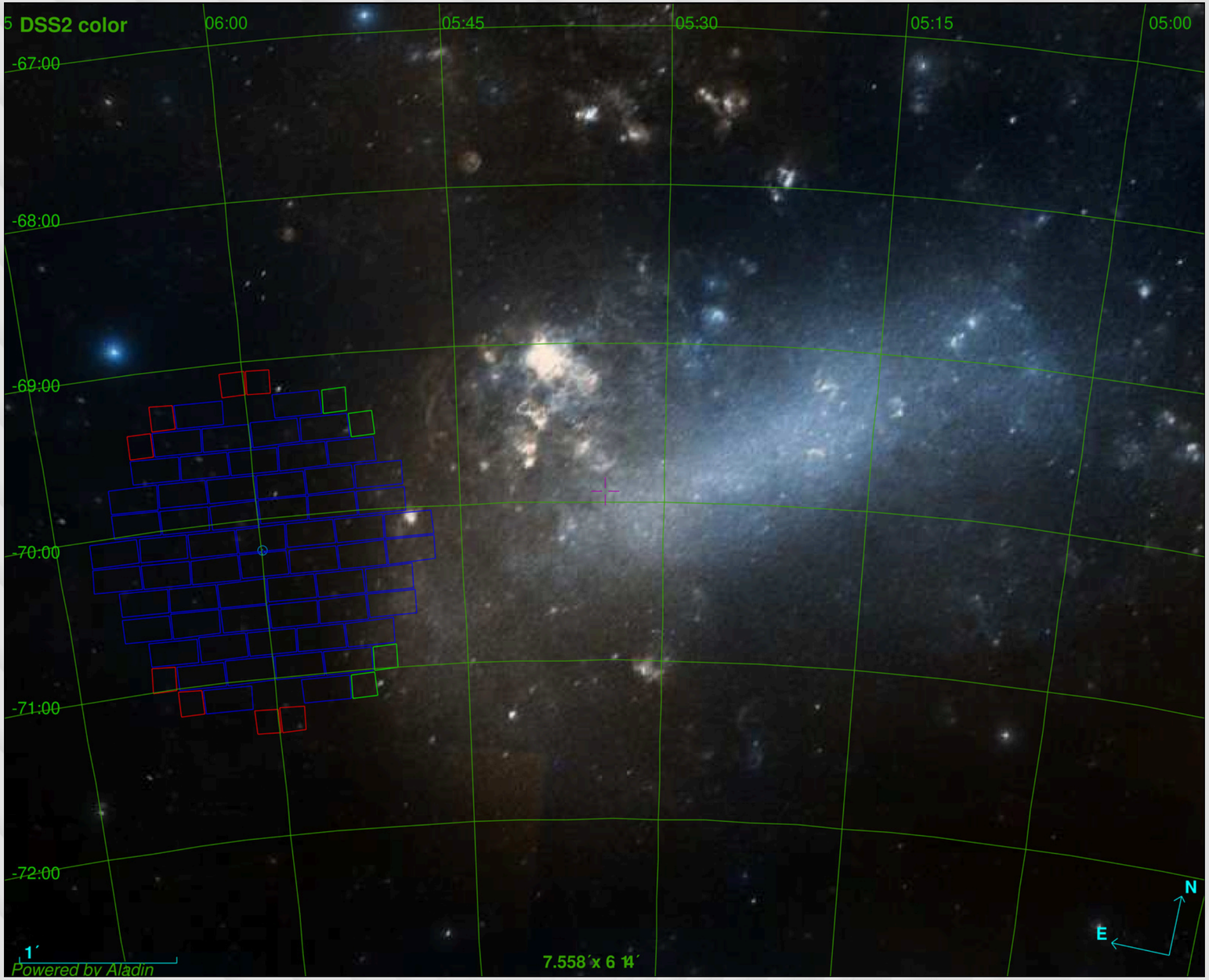
VR filter (626 nm)

40 hours

1 min cadence



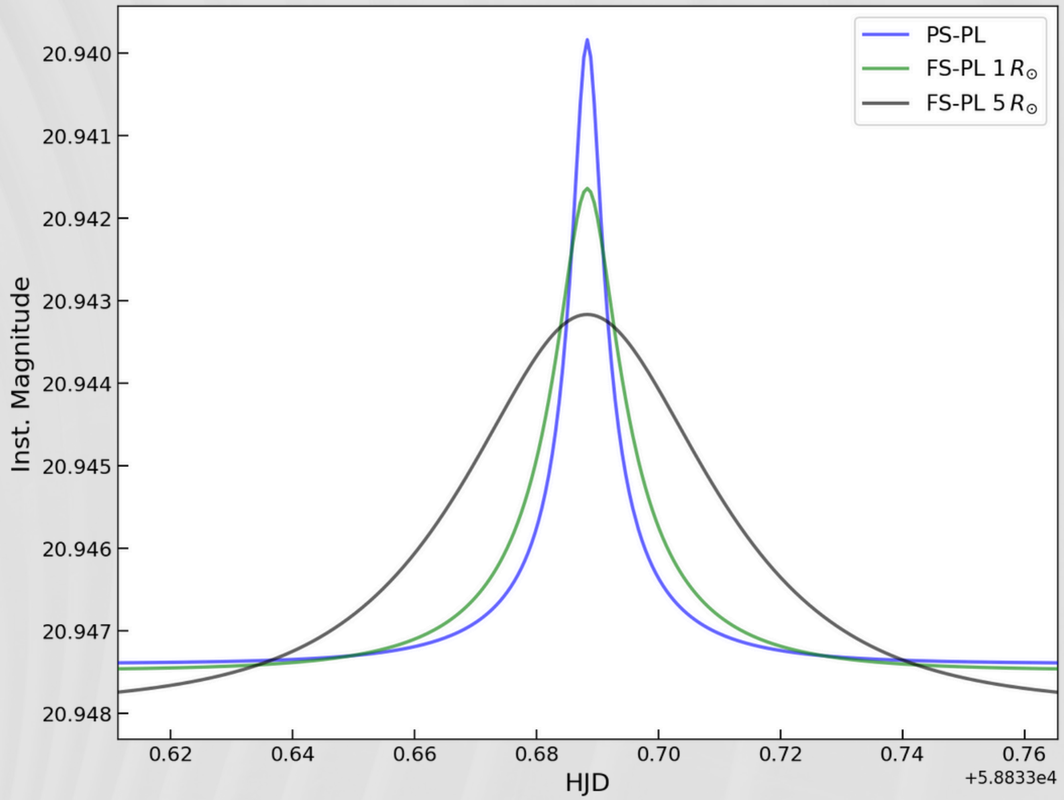



DSS2 color
06:00
05:45
05:30
05:15
05:00
-67:00
-68:00
-69:00
-70:00
-71:00
-72:00
1′
Powered by Aladin
7.558′x 6.14′
N
E

Microlensing with finite sources

$$\rho = \frac{\theta_*}{\theta_E} = \frac{R_* \, D_L}{R_E \, D_S}$$

$$A_{FS}(u, \rho) = \frac{1}{\pi \, \rho} \int_{|\boldsymbol{y}| \leq \rho} A_{PS}(|\boldsymbol{u} - \boldsymbol{y}|) \; d^2 y$$



$$t_E \propto \sqrt{M_{PBH}}$$

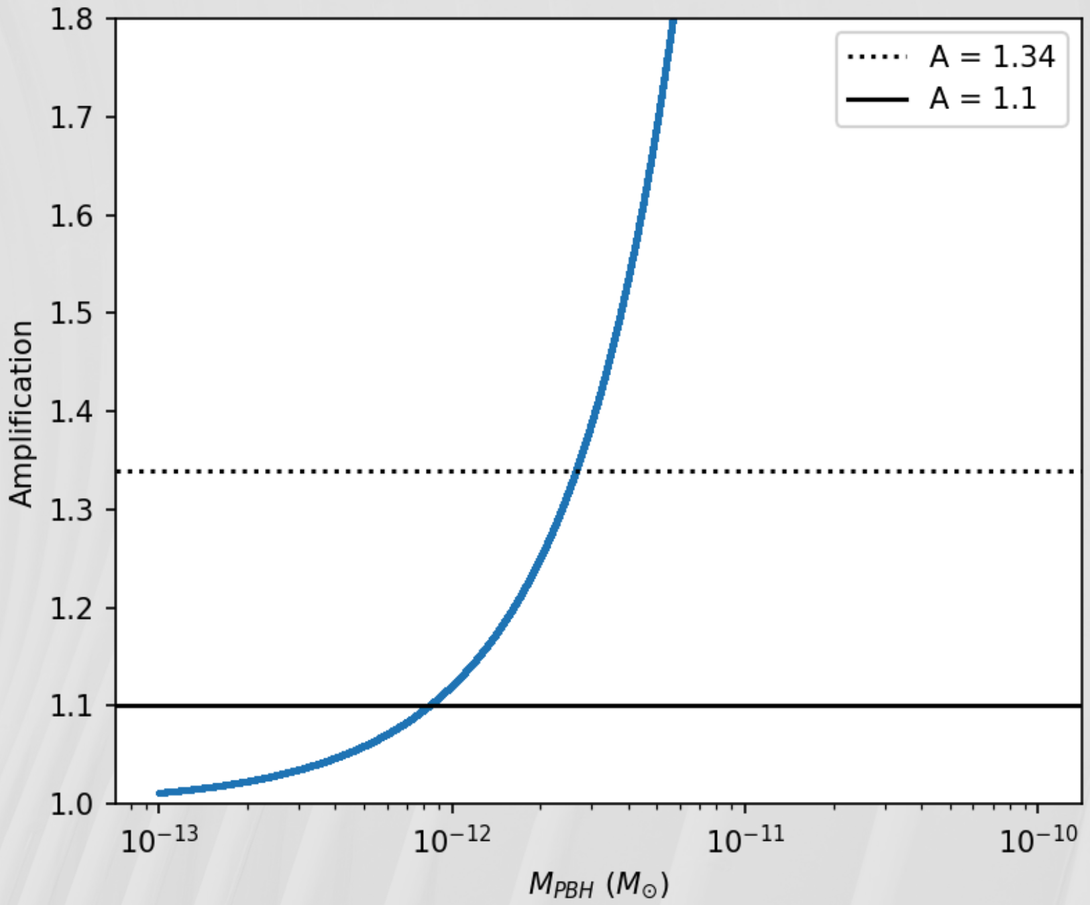
on average, lower mass lenses produce faster events: asteroid-mass events are ~minutes

The theoretical limit of AMPM

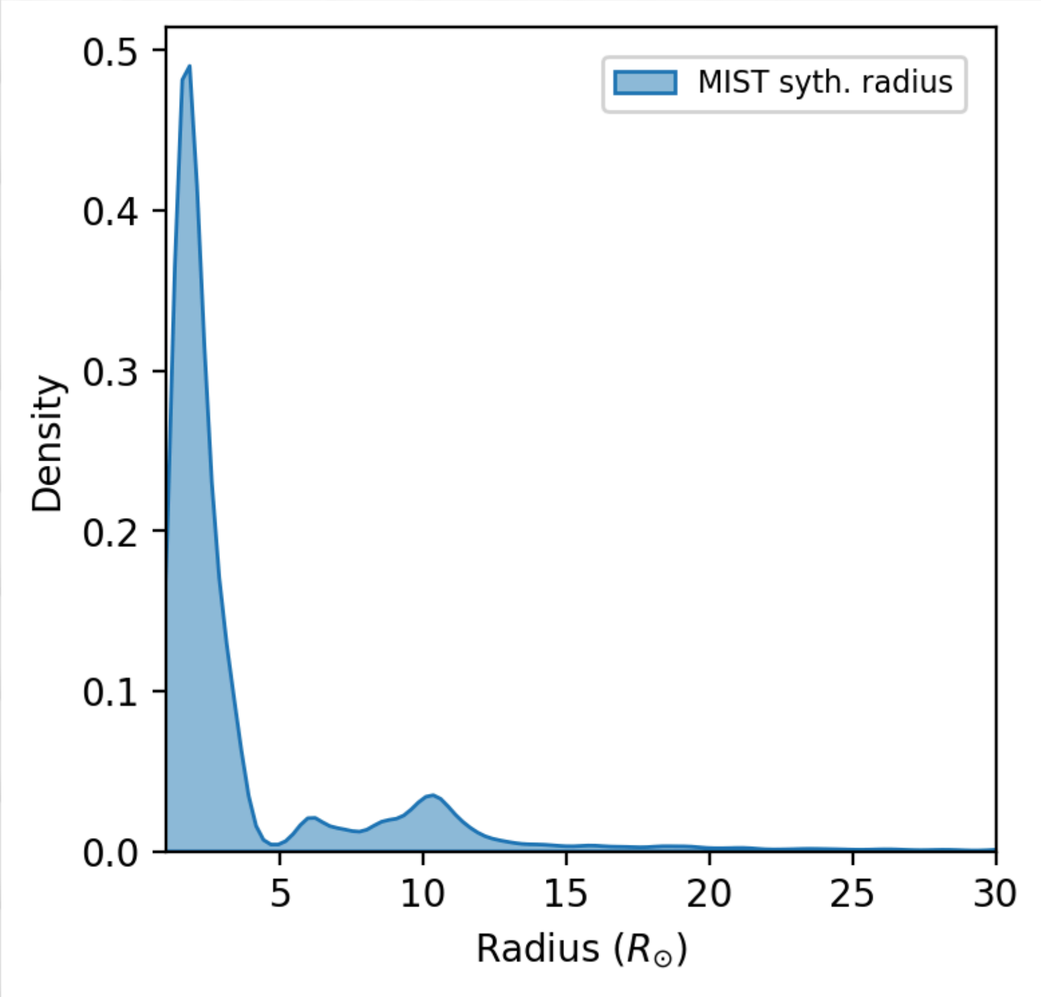
‘wave optics’ - when the Einstein ring radius is comparable to the wavelength of light

$$A_{max}^{wo} = \frac{\pi\omega}{1 - e^{-\pi\omega}}$$

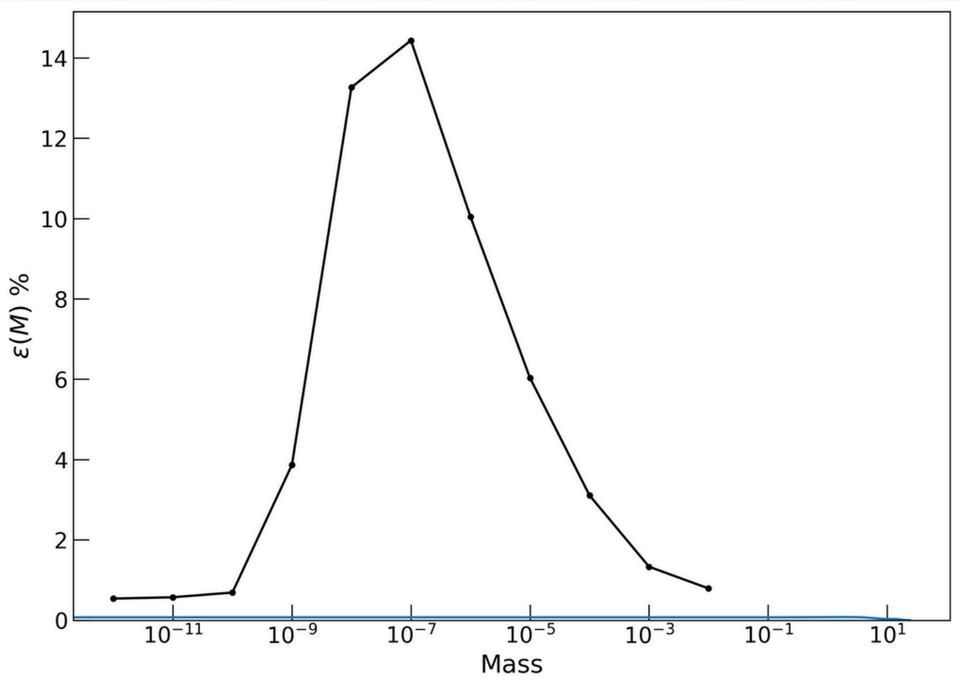
$$\omega \equiv \frac{8\pi G M_{PBH}}{\lambda}$$

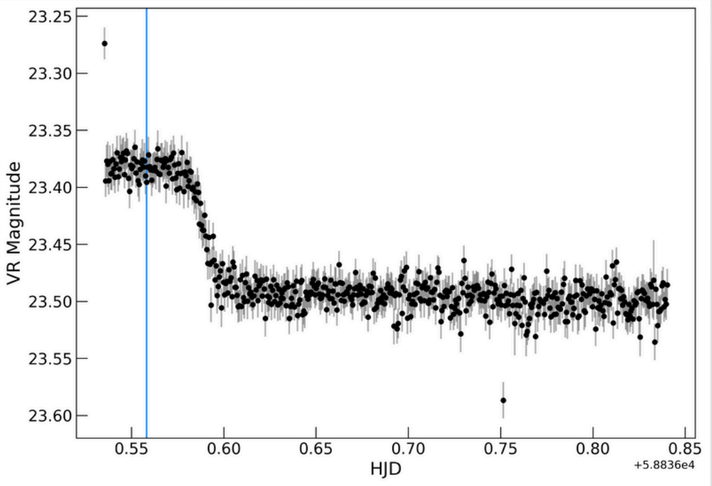


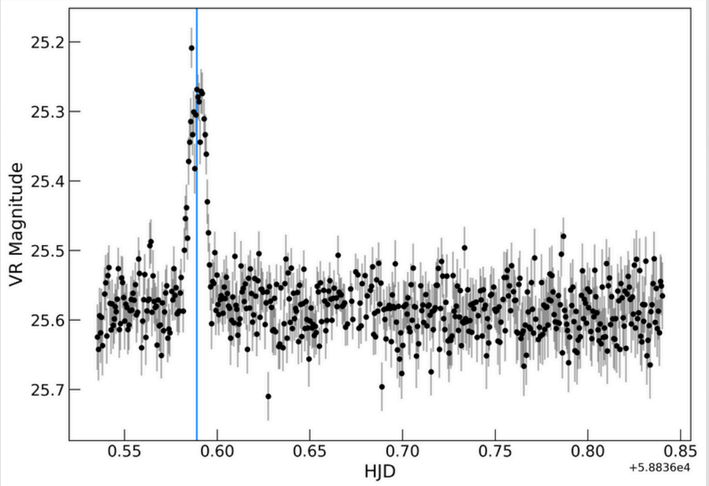
Generating events to test pipeline

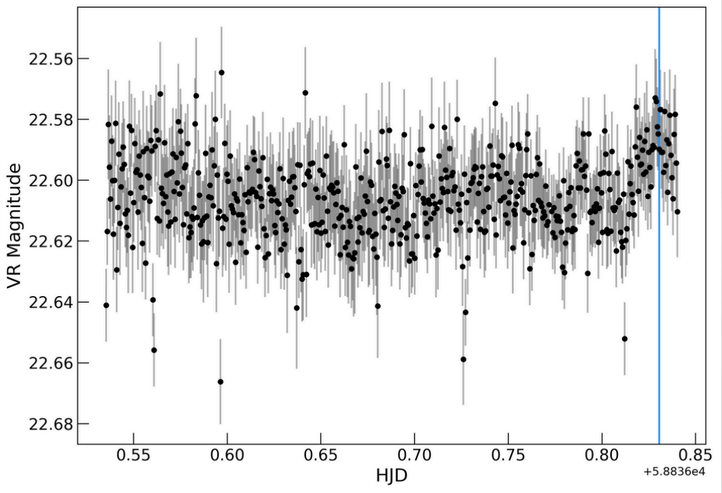


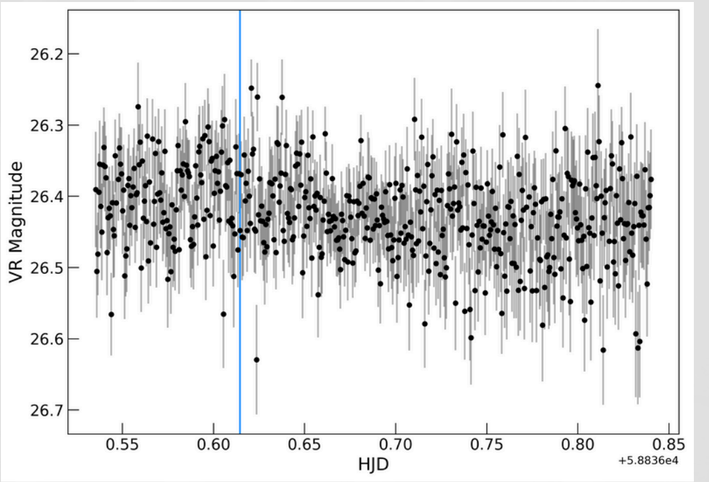
Efficiencies











100000 lenses per mass step

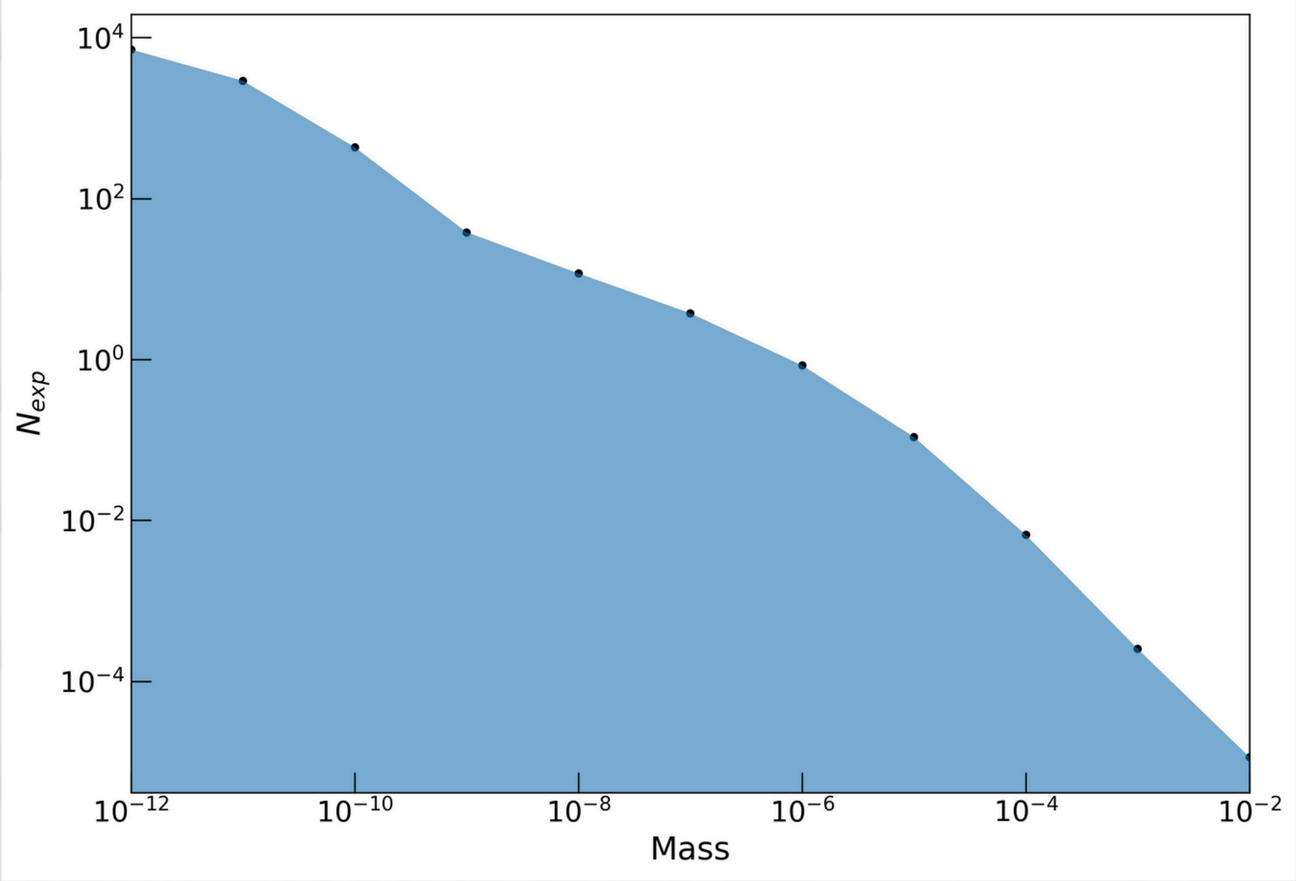
All manner of velocities, stellar radii, lens distances

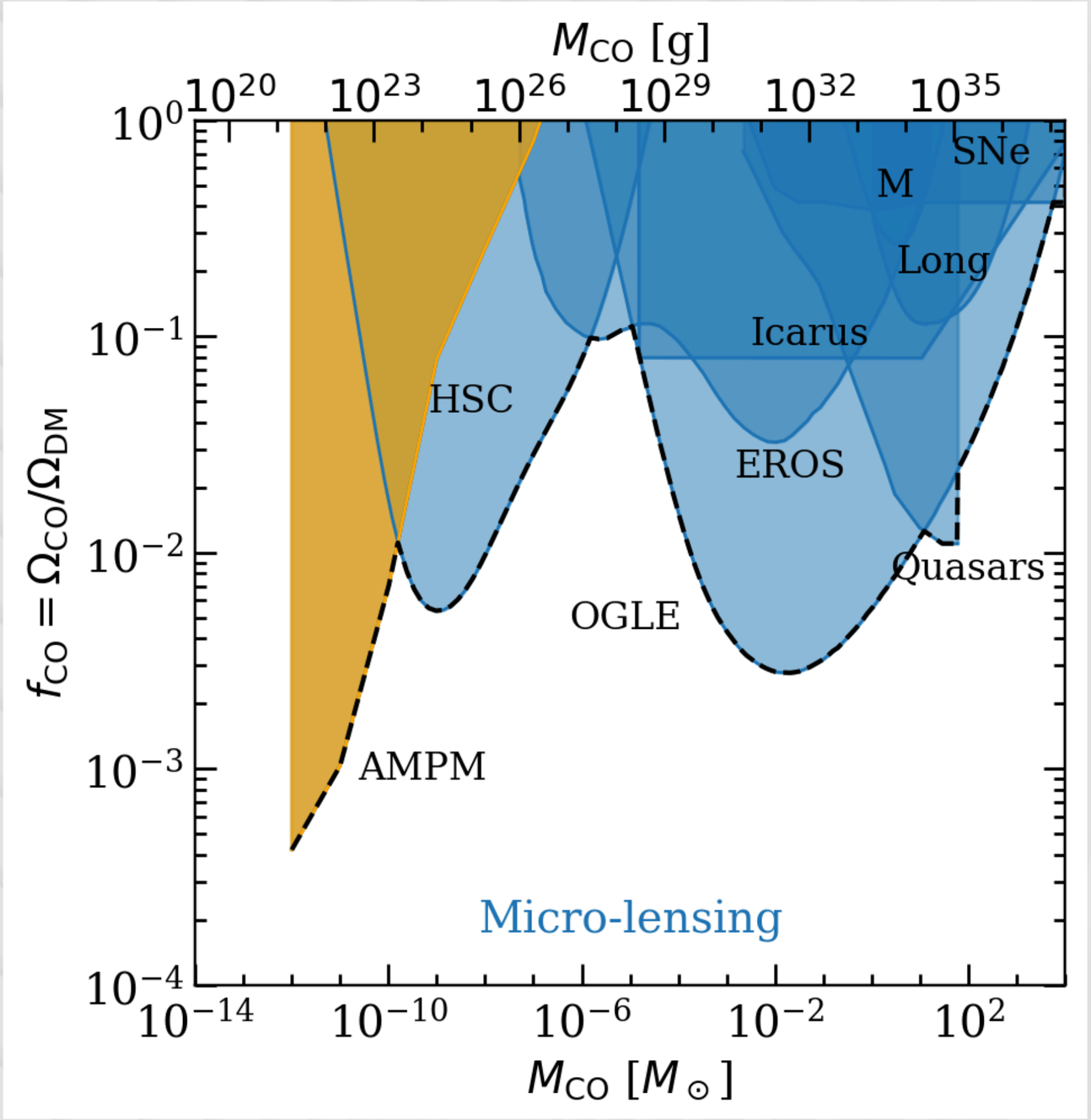
Number of Expected Events for December 18th, 2019

Weighted in Stellar radii bins (MIST photometry)

NFW profile with MW only dark matter

Lots of asteroid mass events, no sub-solar/jupiter mass events





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