AMPM: Asteroid-Mass Primordial black hole Microlensing

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Motivation

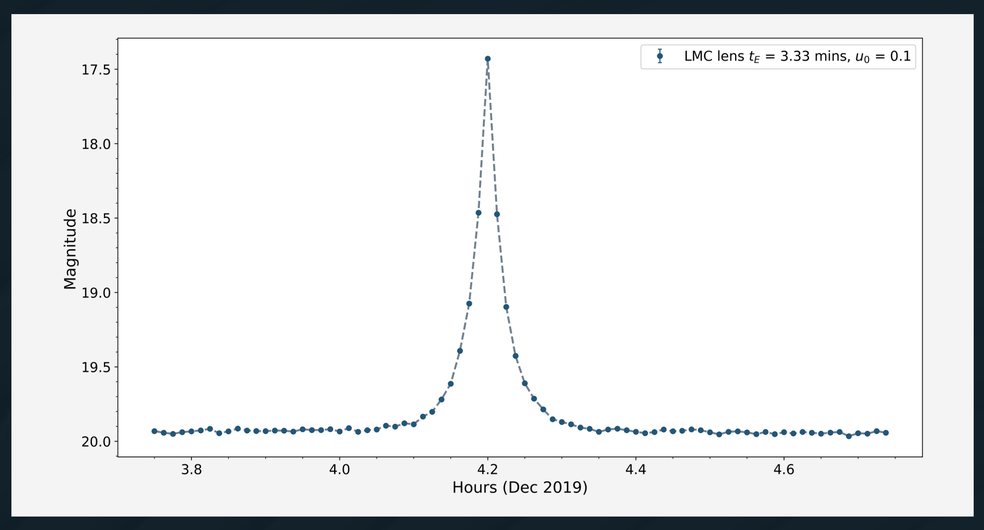
Use DECam high cadence light curves of the LMC to detect, classify and quantify the population of Primordial Black Holes (PBH)

Convert PBH detections into a density limit on the distribution of dark matter in an unconstrained + low-mass regime

Low-mass Regime

Microlensing of PS-PL configurations produces amplification (Paczyński 1986)

$$A(u(t)) = \frac{u^2+2}{u\sqrt{u^2+4}} \qquad \text{with} \qquad u(t) = \sqrt{\frac{(t-t_0)^2}{t_E^2} + u_0^2}$$



and t_E= 200 secs is produced by LMC lensing of $M_{PBH} \sim 10^{-11} M_\odot$

2 Million LMC Sources

Quality control for LC
- Gapless LC
- Stellar object type

~300,000 complete stellar LC

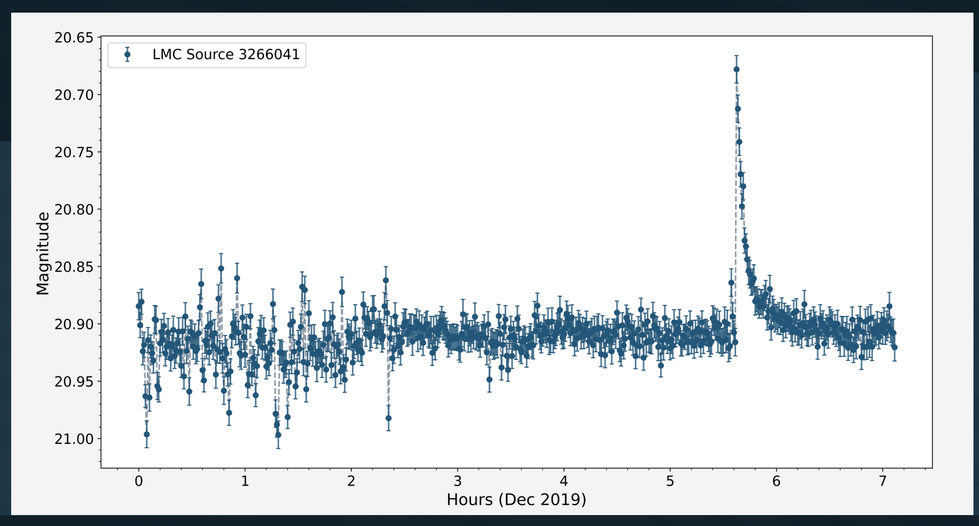
Peak detection
- Highly trended LC
- Variability + Xmatch
- Cosmic ray removal

~100 μLensing style peaks
- MCMC best μlens fit
- Flare star removal
- **Reject seeing flux**

Preliminary Detections

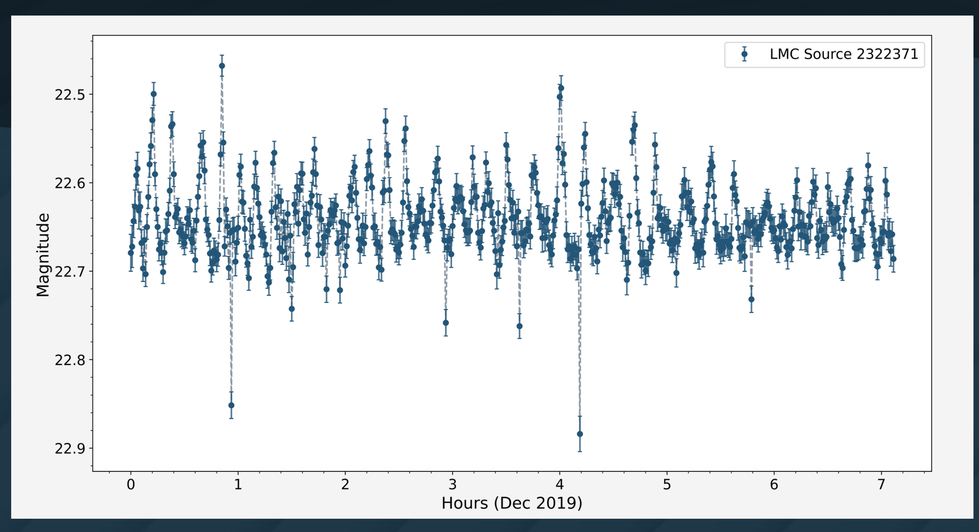
Fast Flares

Use Gaia DR3 parallax and flare model to detect flare stars



ZZ Ceti

Foreground White dwarf with Gaia parallax of 6.02, period of 12 mins



Extensions

Consider PBH-DM using FS-PL. LMC Red Giants pass intial photometry quality control. Produces altered μlens amplification expression + varies the optical depth volume of visible μlensing

Extend from Standard Halo Model to Messy Halo simulations to model deviation away from smooth and homogenous DM assumptions