ACTIVE GALAXIES

Extreme gravitational lensing

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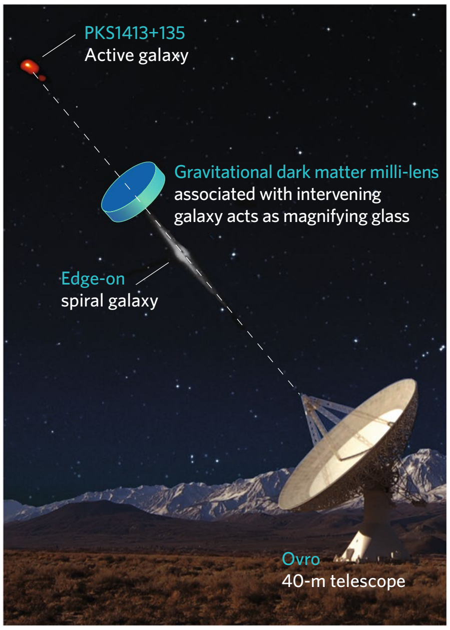

Gravitational lensing is increasingly viewed as an invaluable tool because it hones our view of the lensed source but crucially also probes invisible matter in the lens. Harish Vedantham and colleagues now report a new kind of gravitational lensing that probes angular scales of ~10^{-6} arcseconds, a resolution almost two orders of magnitude finer than otherwise possible with current telescopes.

This impressive feat is achieved due to a blazar — an active galaxy whose relativistic jet points directly towards us — being found behind an intervening object weighing between 10^3 to 10^6 solar masses (potentially a sub-halo or an intermediate-mass black hole in a spiral galaxy). The jet spits out blobs of plasma that are a few light-days wide and move near the speed of light while close to the black hole. As the blobs cross behind the intervening mass they get gravitationally lensed.

Observationally, this is seen as a 'U-shaped' dip and rise of the radio brightness of the blazar as the blob moves behind the lens. While blazars are infamous for brightness fluctuations, in this case, the achromaticity — exact same properties at different radio frequencies — and symmetric temporal evolution of the variations do not match traditional sources of variability. Instead, modelling shows that gravitational lensing naturally explains this combination of characteristics. Future ultrahigh-resolution observations at millimetre wavelengths will put the proposed scenario to the test.

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