

A VLBI study of the Gravitational Lens JVAS B0218+357

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The radio structure of the gravitational lens B0218+357 consists of an Einstein ring and two images separated by ~ 330 mas. Amongst the unexplained observations, the steady and systematic drop in the image flux ratio with decreasing frequency (from ~ 4 at 15 GHz to ~ 2 at 1.7 GHz) is most intriguing given the achromatic behavior of gravitational lensing. One of the possible explanations is a frequency-dependent source structure, combined with an image relative magnification which changes significantly over the extent of the structure (perhaps likely, given the very small image separation). It is indeed common for the radio spectra of AGN jets to steepen with distance from the nucleus, and for the position of the radio peak at the jet base to change with frequency - the "core-shift".

Although such a core shift should, in general, show up as a change with frequency of the separation between the two different core images, this effect is insensitive to core shifts in some directions. An unambiguous registration of the VLBI structures of the images at different frequencies can only be made using the technique of phase referencing. In my talk, I will present results from such VLBI observations made at five different frequencies. In particular, I will highlight the resolution and instrumental effects in juxtaposition to the lens mass-model predictions in order to solve the anomaly concerning the image flux ratios.