Gravitational Lenses as High-resolution Telescopes
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Recent observations show a population of active galaxies with milliarcseconds offsets between optical and radio emission. Such offsets can be an indication of extreme phenomena associated with supermassive black holes including relativistic jets, binary supermassive black holes, or even recoiling supermassive black holes. However, the multi-wavelength structure of active galaxies at a few milliarcseconds cannot be fathomed with direct observations. I will describe how we can use strong gravitational lensing to elucidate the multi-wavelength structure of sources at milliarcsecond scales. When sources are located close to the caustic of lensing galaxy, even small offset in the position of the sources results in a drastic difference in the position and magnification of mirage images. I will demonstrate the power of cosmic lenses to amplify the angular offset in the position of the sources, solution to astrometry, and the probability of finding lensed sources close to the caustic. I will discuss the potential of VLBI observations in synergy with surveys like SKA and Euclid to elucidate multi-wavelength structure for a large ensemble of sources and study the physical origin of multi-wavelength emission, their connection to supermassive black holes, and their cosmic evolution.