

Astrometry with VLBI

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Astrometry with micro-arcsecond accuracy has been obtained with Very Long Baseline Interferometry and the Very Long Baseline Array (VLBA) has been a significant part of this achievement. By directly measuring distances and motions of celestial bodies astrometry serves as the foundation for many areas of astrophysics. Beyond astronomy, the need for fundamental reference frames connects VLBI astrometry to geodesy and geophysics. The Naval Observatory's role as part of the international effort to define and maintain the International Celestial Reference Frame (ICRF) is supported using VLBA observations with other VLBI assets. In this talk I will review some of the highlights of micro-arcsecond relative astrometry obtained with the VLBA, and the Naval Observatory's ongoing work with the VLBA and reference frames. Micro-arcsecond/year relative proper motions are achievable and results for a super massive black hole binary will be presented to illustrate a method to achieve this level of accuracy. While the radio reference frame has a long history of simultaneous observations at S and X bands, there are promising developments at higher frequencies. The last several years has seen observational efforts at K and Ka bands that have the potential to provide a more accurate reference frame. At higher frequencies the more compact structure and smaller frequency dependent core shifts reduce systematics inherent in the source. Arrays with di-chroics provide simultaneous S/X and X/Ka band observations to remove frequency dependent tropospheric and ionospheric effects. K band observations also show promise in this area and these receivers are available on a larger number of antennas and provide a driver for the deployment of dual-frequency capabilities in this band as well. We will discuss some ideas that are being proposed for high frequency astrometry for the VLBA as we recognize the first 25 years of the VLBA.