mm/submm-VLBI of SgrA*: A clear path towards observing a black hole event horizon.

Sheperd S. Doeleman[(1)]
(1) MIT Haystack Observatory, Westford, MA, 01886, USA

Advances in VLBI instrumentation now allow wideband recording that significantly increases the sensitivity of short wavelength VLBI observations. Observing the super-massive black hole candidate at the center of the Milky Way, SgrA*, with short wavelength VLBI reduces the scattering effects of the intervening interstellar medium, allowing observations with angular resolution comparable to the apparent size of the event horizon of the putative black hole. Observations in April 2007 at a wavelength of 1.3mm on a three station VLBI array have now confirmed structure in SgrA* on scales of just a few Schwarzschild radii. When modeled as a circular Gaussian, the fitted diameter of SgrA* is 37 microarcsec (+16,-10; 3-sigma), which is smaller than the expected apparent size of the event horizon of the Galactic Center black hole. These observations demonstrate that mm/sub-mm VLBI is poised to open a new window onto the study of black hole physics via high angular resolution observations of the Galactic Center.

Observations planned over the next five years will deploy enhanced VLBI systems that rely on completely digital backends, high-speed data recorders that use industry standard hard-disks, and phased array processors that can aggregate multiple mm/submm antennas into single VLBI array elements. A parallel exploration of new and highly stable frequency standards for VLBI should enable an extension of the technique to frequencies at or above 345GHz, where angular resolutions on 8000km baselines will correspond to ~2 Schwarzschild radii. These developments, combined with the addition of new VLBI sites in Chile and elsewhere, show that the prospects for probing SgrA* with submm-VLBI to test for time-variable structures and asymmetries are excellent. Realistic simulations that show the capabilities of submm-VLBI to extract fundamental black hole parameters will be discussed, and an assessment of what will be required to realize the observations will be given.