Quasar Astrometry with the Space Interferometry Mission

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The Space Interferometry Mission (SIM) will be the first space-based interferometer designed for precision astrometry, operating in the optical band with a 10-m baseline. As a pointed rather than a survey instrument, SIM will maintain its astrometric accuracy down to very faint magnitudes (about R = 20) allowing the study of quasars and faint stellar populations in our Galaxy. By measuring positions relative to a grid of stars over the whole sky, SIM is expected to yield 4 microarcsecond absolute position and parallax measurements. The SIM Science Team recently selected by NASA will observe with SIM to address a broad range of science questions: including searches for low-mass planets, the formation and dynamics of our Galaxy, calibration of the cosmic distance scale, and fundamental stellar astrophysics. Understanding planetary systems is one of SIM's Key Science projects. With a single-measurement precision of 1 microarcsecond in a local reference frame, SIM will be sensitive to rocky planets around nearby stars and will provide a key contribution to understanding what kinds of system exist, and how they form and evolve.

This talk will highlight one of the SIM Key Science projects: quasar astrophysics. There are 3 basic goals: (1) Does the most compact optical emission from an AGN come from an accretion disk or from a relativistic jet? (2) Do the relative positions of the radio core and optical photocenter of quasars used for the reference frame tie change on the timescales of their photometric variability, or is the separation stable? (3) Do the cores of galaxies harbor binary supermassive black holes remaining from galaxy mergers?

A variety of AGN phenomena are expected to be visible to SIM on microarcsecond scales, including time and spectral dependence in position offsets between accretion disk and jet emission. As well as absolute astrometry, SIM can measure position shifts as a function of color. This is a very powerful technique, allowing us to study quasar structure on angular scales well below the nominal interferometer resolution.