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Progress Report

GEOMETRIC DISTANCES OF QUASARS MEASURED BY SPECTROASTROMETRY AND REVERBERATION MAPPING: MONTE CARLO SIMULATIONS

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Recently, GRAVITY onboard the Very Large Telescope Interferometer (VLTI) first spatially resolved the structure of the quasar 3C 273 with an unprecedented resolution of $\sim 10\mu$as. A new method of measuring parallax distances has been successfully applied to the quasar through joint analysis of spectroastrometry (SA) and reverberation mapping (RM) observation of its broad line region (BLR). The uncertainty of this SA and RM (SARM) measurement is about 16% from real data, showing its great potential as a powerful tool for precision cosmology. We carry out detailed analyses of mock data to study impacts of data qualities of SA observations on distance measurements and establish a quantitative relationship between statistical uncertainties of distances and relative errors of differential phases. We show that SARM analyses of observations generally generate reliable quasar distances, even for relatively poor SA measurements with error bars of 40% at peaks of phases. Inclinations and opening angles of BLRs are the major parameters governing distance uncertainties. It is found that BLRs with inclinations $\gtrsim 10$ deg and opening angles $\lesssim 40$ deg are the most reliable regimes from SARM analysis for distance measurements. Through analysis of a mock sample of AGNs generated by quasar luminosity functions, we find that if the GRAVITY/GRAVITY+ can achieve a phase error of 0.1 deg per baseline for targets with magnitudes $K \lesssim 11.5$, the SARM campaign can constrain H_0 to an uncertainty of 2% by observing 60 targets.