VLBI Astrometry of Radio Stars to Link Radio and Optical Celestial Reference Frames

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Abstract

The Gaia Celestial Reference Frame (Gaia-CRF) is linked to the International Celestial Reference Frame (ICRF) at the faint end (G> 17) using quasars, but at the bright end, especially for G< 13, there are no available quasars to verify the consistency of Gaia-CRF. Using Very Long Baseline Interferometry (VLBI) to observe a group of radio stars and achieve the link between Gaia-CRF and ICRF at the bright end is a feasible plan.
Currently, only a few dozen radio stars are available for CRF link, far less than the number of quasars (thousands), so the focus is on increasing the number of available radio stars.
We have now used VLBI to perform five-parameter astrometry on a group of radio stars, but it is inefficient due to the large number of observing epochs and long observing time required for five-parameter astrometry.
Therefore, we propose an observation strategy using only two epochs to improve observation efficiency.
Since it is difficult to accurately determine the absolute position of radio stars in the solar system barycentric coordinate system through two epochs, we first proposed a method to link CRFs based on the individual positions of radio stars, i.e., the positions without parallax correction.
In addition to verifying our method on existing data, we also simulated and compared the efficiency differences between different observation strategies.
The simulation results show that under the same observation cost, the double-epoch strategy has about 20% and 30% precision improvement in the orientation and spin parameters respectively compared with the five-parameter strategy.
If 45 radio stars (position accuracy _˜50 uas) are observed using the double-epoch strategy based on existing data, the uncertainties of orientation and spin parameters will be reduced by about 30% and 80% respectively.
This poster will introduce our completed and ongoing radio star observations, CRF link method based on radio star individual positions, and simulation methods and results of different observation strategies.

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