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The XKa Celestial Reference Frame: Assessing Accuracy

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Observations at X/Ka-band are motivated by their ability to access more compact source morphology and reduced core shift relative to observations at the historically standard S/X-band. In addition, the factor of four increase in interferometer resolution at Ka-band should resolve out some wide binary black holes which are a topic of concern
for AGN centroid stability.

Given these motivations, an X/Ka-band (8.4/32 GHz) celestial reference frame has been constructed using a combined NASA and ESA Deep Space Network. In 124 observing sessions we detected 673 sources covering the full 24 hours of right ascension and the full range of declinations. The resulting XKa median precision is now better than the ICRF-2 precision thereby raising the question of which frame is more accurate.

Comparison of over 500 X/Ka sources in common with the S/X-band (2.3/8.4 GHz) ICRF2 produced wRMS agreement of about 200 microasec. There is evidence for systematic errors above the 100 microasec level. Known errors include limited SNR, lack of phase calibration, troposphere mismodelling, and terrestrial frame distortions. Actions are underway to reduce all of these errors. In particular, a collaboration between NASA and the ESA deep space antenna in Malargüe, Argentina is quickly reducing weaknesses in the southern hemisphere. By looking at the best observed sources, we probe the accuracy limits of current celestial frames in an effort to understand the advantages of each frame.

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