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VLBI with the SKA

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1 Extended Abstract

With the advent of the SKA, VLBI will continue to play an important role in scientific discovery across a range of scientific topics. These include pulsar astrometry (including scintellometry), maser astrometry, AGN and jet physics, and a wide range of transient phenomena such as Gamma Ray Bursts, Tidal Disruption Events and Extreme Scattering Events. For SKA phase 1, milliarcsecond resolution will be achieved by combining the phased SKA1-MID core with existing, or soon to be completed, VLBI networks distributed across the globe. SKA-LOW will be used in a similar way providing $\sim$ 100 mas resolution at frequencies below 500 MHz, with usage likely to focus on scintellometry. The European VLBI Network, Long Baseline Array and nascent African VLBI Network are expected to play major roles in forming these arrays. The resultant arrays will provide greatly enhanced sensitivity compared to what can currently be achieved over most of the sky.

Of foremost scientific interest is the leap in astrometric performance that this sensitivity improvement will provide. Astrometric precision of 10 microarcseconds should be more or less routine with SKA-VLBI, with 1 microarcsecond precision attainable. This improvement in routine astrometric performance is in the first instance a natural consequence of the much greater density of calibration sources which will be available with the more sensitive array. Astrometric accuracy improves roughly linearly with decreasing target-calibrator separation, with a further improvement ensuing once you enter a regime where target and calibrator can be observed simultaneously in a single pointing. However, the ability to take full advantage of these developments hinges on a number of technical issues including, but not limited to:

- astrometric techniques
- understanding the positional stability of the faint radio sources
- understanding (and mitigating) the effects of interstellar scattering on the apparent positions of faint radio sources
- observational flexibility (in time and frequency)
- multi-beam capability of the SKA core (and other sensitive telescopes, especially phased arrays)
- availability of telescopes in strategic locations
- calibration software

There have been developments on all of these issues in recent years, but with significant work still to be done before the potential of SKA-VLBI can fully be realised. In this talk we will discuss some of those recent developments and look forward to the likely paths for future advances.