VLBI Fundamentals

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Very Long Baseline Interferometry is a microwave-based space geodetic technique that measures the difference in arrival times of signals from a radio source by cross correlation. Most commonly the observed radio sources are extragalactic objects but beacons from satellites have also been used. VLBI plays a unique role in the practical realization and maintenance of the International Celestial Reference Frame (ICRF) and contributes significantly to the International Terrestrial Reference Frame (ITRF), in particular for its scale. It is the only technique that provides the full set of Earth orientation parameters, which are indispensable for positioning and navigation on Earth and in space. In addition VLBI allows access to valuable information concerning interactions within the Earth system. In particular, direct measurements of nutation parameters and of the Earth rotation angle ($UT1-UTC$) are uniquely provided by VLBI. Furthermore, several other geodynamic, atmospheric, and astronomical parameters can be derived from the long history of VLBI measurements starting in the late 1970's. In 1999, the International Association of Geodesy (IAG) accepted the International VLBI Service for Geodesy and Astrometry (IVS) as an official IAG Service and the IVS was also approved as a Service of the International Astronomical Union (IAU). Since then, the coordination of world-wide VLBI observation and analysis has improved significantly, leading to valuable results for the wider scientific community. Since 2005, the IVS has been working on a new VLBI system in terms of hardware, software, and operational procedures, known as VLBI2010. The IVS recommended a review of all current VLBI systems and processes from antennas to analysis and outlined the path to the next-generation system with unprecedented new capabilities envisaged: 1 mm position and 0.1 mm/yr velocity accuracy on global scales, continuous measurements to obtain uninterrupted time series of station positions and Earth orientation parameters, and a turnaround time from the observations to initial geodetic results of less than 24 hours. This new system will be realized in the coming years.

The VLBI fundamentals chapter is subdivided into the following sections:

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