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# THE SHAPIRO TIME DELAY IN THE EATH'S GRAVITATIONAL FIELD

**Abstract**

One of the most prominent predictions of Einsteins General Relativity revolutionizing our understanding of space and time is that clock comparison is influenced by the the gravitational potential and their state of motion. Major gravity effects are the gravitational redshift, the gravitational time delay (Shapiro effect), and the gravitomagnetic clock effect. The clocks under consideration are standard clocks which uniquely can be defined within General Relativity and which are with high precision realized by atomic clocks. Owing to its fundamental importance in General Relativity, its practical applications in metrology, positioning, and geodesy, as well as the incompatibility of the notion of time in General Relativity and quantum mechanics, all clock effects have to be tested with the best accuracy. The best test of the gravitational redshift has been recently reported by us. The best test of the gravitational time delay is from the Cassini Saturn mission. For the gravitomagnetic effect no experiment has been carried through until now. In this contribution the gravitational time delay effect will be considered. Taking this effect into account in the vicinity of the Earth amounts to a repositioning of objects in space by approx. 1 cm. The idea now is to use GNSS data in order to try to obtain an improved test of the gravitational time delay due to the gravitational field of the Earth and other bodies. The disadvantage of measurements in the gravitational field of the Earth compared to the until now best Cassini measurements using the Sun is the weaker gravitational field. However, there are two advantages: the faster change of the impact parameter (closest distance of the signal to the center of the gravitating body) by at least one order of magnitude, and the much better statistics (there are more 100 satellites in orbit). A first estimate gives that under these circumstances clocks with an accuracy of $10^{-16}$ may give a test of the time delay of the order of the Cassini measurements. In this talk a more detailed analysis of this proposal is presented.