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Test of Time-Reversal Invariance at COSY

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Time-reversal symmetry is one of the most fundamental symmetries in nature. CP-violation phenomena, which can be regarded as equivalent to T-violation provided that CPT is conserved, have been observed in the $K0$ and B systems. Currently all observed CP phenomena appear to be consistent with the standard model (SM) predictions. However, it is well known that in the SM this CP violation is many orders of magnitude too small to account for the apparent asymmetry between matter and anti-matter in the Universe.

The current upper limit for (parity-conserving) time-reversal non-invariance was obtained through measuring the total cross sections of a polarized neutron beam incident on a Holmium target. However, the interpretation of such data at a fundamental level is difficult due to the use of a complex nuclear targets. The theoretical understanding of measurements with a polarized proton beam and a deuterium target would certainly be much cleaner.

In order to improve the Holmium limit by an order of magnitude, the parity-conserving time-reversal violating observable $A_{y,xz}$ in proton-deuteron forward scattering would have to be measured with an accuracy of 10^{-6}. Such a measurement is planned as an internal target transmission experiment, requiring the use of a polarized proton beam and a tensor polarized deuterium target. In this experiment the COSY ring would serve simultaneously as accelerator, ideal forward spectrometer, and detector.

An openable storage cell and holding magnetic field system have recently become available at the low beta section of the COSY ring where the PAX studies are undertaken. Much more stable beam conditions can be achieved here than elsewhere in the ring. Using the large acceptance PAX detector system, in addition to performing a measurement of $A_{y,xz}$, it is also possible to search for violation of time-reversal invariance in differential observables.

The current status of the preparations for this experiment will be presented.

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