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New Active Feedback Scheme for Minimization of Instrumental Asymmetries¹

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Chiral effects in nature exist but are generally difficult to detect. A University of Nebraska Lincoln experiment to detect electron circular dichroism by sending polarized electrons through a chiral medium has met with difficulties in reducing the instrumental asymmetry below the expected true asymmetry of $\sim 10^{-4}$. In order to minimize this false asymmetry, a new optical apparatus designed for the production of polarized electrons has been built. It is based on the fast chopping of two spatially separated beams of light with orthogonal linear polarizations which are recombined and passed through a quarter wave plate to yield a single beam with rapidly flipping helicity. New methods for measuring the helicity-dependent intensity asymmetry in this apparatus have been developed. These methods show that the main reason for large instrumental asymmetries is drift due to laser polarization instability. Active electro-optical feedback has been successfully employed to maintain this asymmetry below 2×10^{-5} .

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