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Orbital Angular Momentum Imprints Studied Using Optical Vortex Pump-probe Spectroscopy[1] M. A. NOYAN, A. L. EXARHOS, J. M. KIKKAWA, Department of Physics and Astronomy, University of Pennsylvania — We introduce a second generation magneto-optical spectroscopy based on orbital angular momentum of light. Our technique is analogous to methods such as time resolved Faraday/Kerr rotation, but instead of utilizing photon spin, we use holographic gratings to pump and probe materials using photons carrying *orbital* angular momentum (OAM). We will discuss our first time resolved experiments studying pump-induced OAM dichroism in bulk semiconductors. 100 fs pump pulses with alternating orbital angular momentum $\pm\hbar$ create OAM imprints whose momentum distributions resemble right- or left-handed "whirlpools" or vortices. The OAM memory of the sample is then measured using a probe beam whose $\pm\hbar$ OAM components are detected in a balanced photodiode bridge. We find that in n-GaAs, the dynamical OAM signal shows a unique timescale when compared to population and spin dynamics and, surprisingly, lasts considerably longer than the momentum scattering time. This method should be of further interest for studying non-equilibrium dynamics in a variety of orbitally coherent systems.

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