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Photochemical and Photophysical Dynamics of Persistent Spectral Hole-Burning, Photorefractivity, and Single Molecular Absorbers in Condensed Matter

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31 August 1992

During the period of this contract, the following milestones have been achieved: the first detailed studies of hole-burning bottlenecks for organic and inorganic systems; first use of high resolution ultrasonic modulation to detect photochemical holes; first observation of photochemical hole production in 100 ns; first complete analysis of coupled reading-writing constraints for single-photon hole-burning materials leading to the need for photon-gating; first observation of photon-gated hole-burning in an organic system; first observation of photon-gating via a donor-acceptor electron transfer mechanism, which allows fast (30 ns) hole formation in small focused laser spots; first observation of statistical fine structure in an inhomogeneously broadened spectral line; first optical detection and spectroscopy of a single impurity molecule in a solid; first temperature dependence of photon-gating to 90 K; first intracavity second harmonic generation in an organic crystal; first phase-sensitive, time-resolved study of ballistic phonon propagation in a solid; first direct observation of spectral diffusion in a solid using a single-molecule probe; first observation of lifetime-limited linewidths, dephasing, and nonlinear saturation for a single molecule; first observation of hole-burning and spectral diffusion for a single molecule in a polymer; first observation of photoinduced reaction kinetics for a single molecule; first observation of photon antibunching for a single molecule in a solid; first observation of hole-burning and spectral diffusion for a single molecule in a polymer; first observation of photon antibunching for a single molecule in a solid; first observation of photorefractivity in a polymer; and first demonstration of two-beam coupling in a photorefractive polymer.

The following postdoctoral Visiting Scientists have been supported under this contract: Alan Huston, Howard W. H. Lee, Thomas P. Carter, Lothar Kador, Stephen Ducharme, W. Pat Ambrose, and Thomas Basché.

This work is summarized in the thirty-seven interim technical reports presented to the Office of Naval Research and in the following publications:

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