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Control of Spectrally-Manifested Decoherence in Giant Rabi Sidebands[1] DMITRI A. ROMANOV, Department of Physics and Center for Advanced Photonics Research, GEORGE HECK, ALEX FILIN, ROBERT J. LEVIS, Department of Chemistry and Center for Advanced Photonics Research, Temple University, Philadelphia, PA 19122 — We study the broadband Rabi oscillations supported by excited states of oxygen atoms in a laser-generated microplasma. The dynamic Rabi sidebands show characteristic fringe patterns of spatial-spectral interference. The variable contrast of these patterns is determined by decoherence phenomena in the nonequilibrium underdense microplasma channel, with corresponding decoherence times in the range of 750 fs to 3 ps. We have determined the decoherence rate as a function of the pump pulse intensity and the pump-probe delay time. The rate increases with the pump laser intensity and decreases with the delay, in good agreement with model calculations, revealing that electron scattering dominates the dynamics for the subnanosecond relaxation processes. The results provide insight into both the behavior of the transient effective two-state systems and the evolution of the characteristics of the laser-generated microplasma.

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