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Fast Acting Optical Forces From Far Detuned, High Intensity Light[1] CHRISTOPHER CORDER, BRIAN ARNOLD, XIANG HUA, HAROLD METCALF, Physics Dept., Stony Brook University, Stony Brook NY 11794-3800 — We are exploring fast acting, strong optical forces from standing wave light fields with high intensity and large detuning $\delta \gg \gamma$, where γ is the transition linewidth. We observe these fast acting forces on a time scale of a few times the excited state lifetime $\tau \equiv 1/\gamma$; thus an atom may experience at most one or two spontaneous emission events. The dipole force is typically considered when the Rabi frequency $\Omega \ll \delta$, but we use $\Omega \sim \delta$ so the usual approximations break down because a significant excited state population can occur, even for our short interaction times that limit spontaneous emission. Our experiment measures the transverse velocity distribution of a beam of 2^3S He after a chosen interaction time with a perpendicular standing wave detuned from the $2^3\mathrm{S}\rightarrow 3^3\mathrm{P}$ transition near 389 nm. The distribution shows velocity resonance effects that persist over a large range of Ω. We also simulate the experiment numerically using the Optical Bloch Equations and the results are consistent with our measurements.

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