Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Can a photon saturate an atom without being absorbed? JOSIAH SINCLAIR, DANIELA ANGULO, KYLE THOMPSON, Univ of Toronto, KENT BONSMA-FISHER, National Research Council of Canada, AEPHRAIM STEINBERG, Univ of Toronto — As a resonant photon passes through a cloud of two-level atoms, it weakly saturates the atomic transition, modifying the index of refraction of the cloud, which can be measured as a nonlinear cross-phase shift (XPS) on a second, off-resonant beam. In cases where a photon is observed at a detector on the far side of the cloud, one might conclude that it had not been absorbed and that there should therefore be no XPS. In our experiment on absorptive optical nonlinearities in cold ^{85}Rb, we use post-selection to isolate the phase shift imparted by a transmitted photon. We find that despite not having been absorbed, transmitted photons impart a significant fraction (0.77+/-0.17) of the nonlinear XPS of the average incident photon, raising questions about the relationship between atomic excitation, absorption, and scattering at the fully quantized level.

Josiah Sinclair
Univ of Toronto

Date submitted: 29 Jan 2020 Electronic form version 1.4