Abstract Submitted
for the TSF11 Meeting of
The American Physical Society

Kinetics And Optical Properties Of The Strongly Driven Gas Medium Of Interacting Atoms ANDRII SIZHUK, Physics Department, TAMU 77843, PHILIP HEMMER, Electrical and Computer Engineering, TAMU — This paper investigates stimulated emission and absorption near resonance for a driven system of interacting two-level atoms. Microscopic kinetic equations for the density matrix elements of N-atom states including atomic motion are built, taking into account atom-field and atom-atom interactions. Analytical solutions are given for the resulting macroscopic equations in different limits, for the system composed of a strong coherent "pump" field and a weak counter-propagating "probe" field. It was shown that the existence of a dipole-dipole (long-range) interaction between atoms separated by distance less than the pump wave-length can cause the formation of periodic polarization and population structures (gratings in time and space) in the pumped medium without a probe field. The "interaction" between pump and probe induced polarization/population gratings through a dipole-dipole interaction mechanism causes the absorption line shape asymmetry. This asymmetry is revealed in increasing probe gain for the "red"-shifted (relative to pump) probe and suppressing the gain for the "blue"-shifted probe field when pump is "red"- shifted relative to the ensemble averaged resonant frequency. The theoretical results are consistent with experimental data for the probe gain as the function of frequency and atomic density for sodium vapor with the pump laser tuned near D_2 line. Here the dependance of gain on particle density was explained in the terms of the long-range interaction between the atoms.

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Date submitted: 17 Aug 2011 Electronic form version 1.4