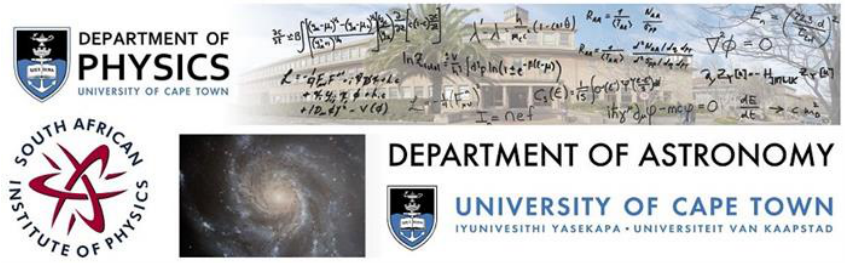

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Nonlinear optical processes and saturated absorption spectroscopy in two and multi-level atoms: a theoretical and numerical study

Wednesday, 6 July 2016 16:10 (1h 50m)

Abstract content
   (Max 300 words)
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In this presentation we report on the study of two-level and multi-level atoms interacting with one or more laser beams. The system is analyzed using the semi-classical approach where the dynamics of the atom is described quantum mechanically using the Liouville equation, while the laser is treated classically using Maxwell's equations.

Firstly, we present results of a two-level atom interacting with a single laser beam and demonstrate Rabi oscillations between the two levels. We then examine the effects of laser modulation on the dynamics of the atom. Plots of the density matrix elements (population and coherence terms) as a function of time are presented for various parameters such as laser intensity, detuning, modulation etc. In addition phase-space plots and Fourier analysis of the density matrix elements are provided. The atomic polarization is estimated from the coherence terms. This, together with the populations, is used to determine the behavior of the laser beams as they pass through the atomic ensemble.

The behavior of the laser as it propagates through the atomic ensemble is studied by solving Maxwell's equations numerically, initially with an assumed polarization and population from theory and later from the solution of the Liouville equation. The two-level system is further extended to include a second counter propagating laser beam and the effects of saturation and hole burning is demonstrated.

The above work will be expanded to simulate saturated absorption spectroscopy of Rubidium gas.

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