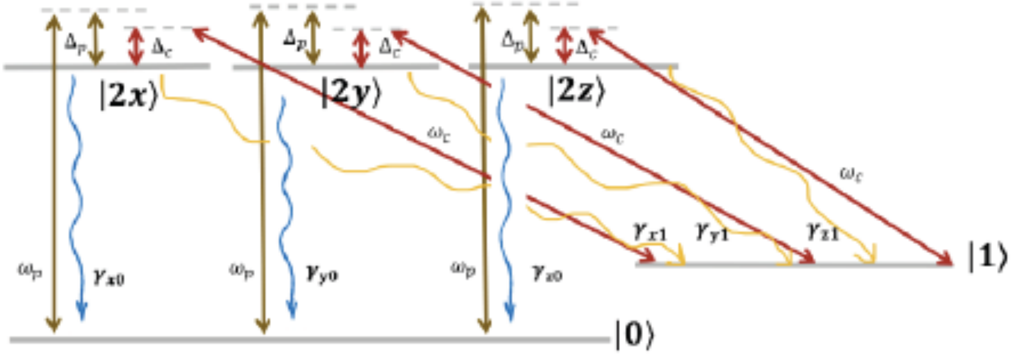
Modelling of Electromagnetically Induced Transparency (EIT) in an Atomic Ensemble

EIT is an optical phenomenon in which a medium normally opaque to an electromagnetic field (probe) is made transparent upon application of a stronger electromagnetic field (control). Though experiments are carried out in atomic ensembles, theories use single atoms. We use the effective single particle model for an ensemble of three-level 'Lambda' systems.

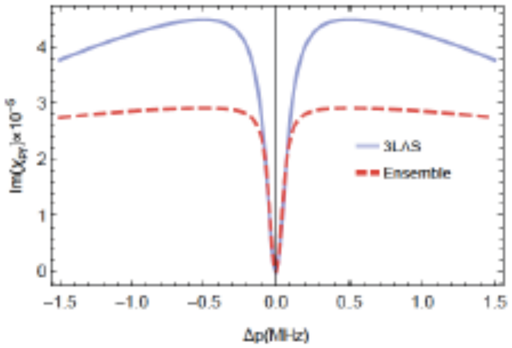


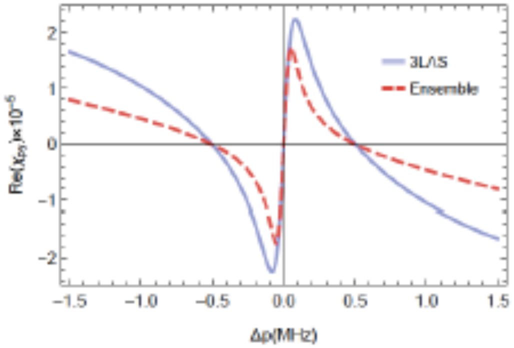
Solving the Lindblad-von-Neumann equation

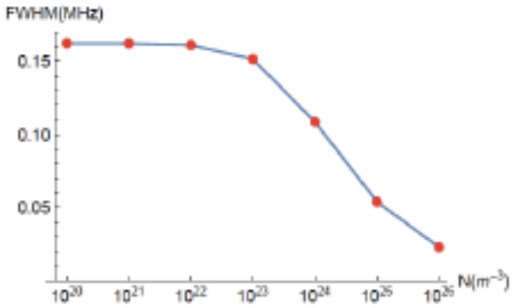
$$\dot{\rho} = -\frac{i}{\hbar}[H,\rho] - L(\rho)$$

We can calculate the susceptibility

$$\chi_{py} = \frac{2N\mu_{02y}^2}{\epsilon_0 \hbar \Omega_{py}} \rho_{2y0}.$$







Dependence on the number density of the ensemble shows that EIT is feasible for N < 10^{23} atoms/m^3.

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