## Abstract Submitted for the DAMOP10 Meeting of The American Physical Society

Spectral narrowing induced by discrete frequency fluctuations YOAV SAGI, RAMI PUGATCH, IDO ALMOG, NIR DAVIDSON, Department of Physics of Complex Systems, Weizmann Institute of Science, Rehovot, Israel — We study an ensemble of two level systems coupled to an environment that randomly modulates their resonant frequency. We use Poissonian statistics for the random frequency jumps and derive a closed-from formula for the spectrum in terms of the inhomogeneous frequency distribution and the Poisson rate constant. We show that for a Gaussian distribution our result asymptotically reproduces the results of the well known Kubo model. Our formula holds for any frequency distribution. In particular we calculate the spectrum of atoms in a 3D trap harmonic trap and show that motional narrowing naturally emerges. We experimentally measure this spectrum with optically trapped  $^{87}Rb$  atoms and obtain a good agreement to our theory without fitting parameters. Our theory apply to a wide range of systems such as atomic ensembles, nuclear magnetic resonance spectroscopy, single molecule spectroscopy and the line-shape of lasers.

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