Superradiance in ensembles of strontium-88 with inhomogeneous broadening

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A bad cavity laser is a laser for which the linewidth of the cavity mode is broader than the gain profile. The frequency of radiation emitted by such a laser is robust with respect to fluctuations of the cavity length, which opens the possibility to create a highly stable active optical frequency standard. We will discuss the possibility to create such a standard on the basis of the forbidden \( ^3P_0 \rightarrow ^1S_0 \) transition in bosonic Sr atoms.

Superradiant laser as active optical clock: a concept

Good- and bad-cavity lasers

Superradiant bad-cavity laser

Possible schemes of continuous-operating source on the \( ^3P_0 \rightarrow ^1S_0 \) transition of Sr

Single optical conveyor

Sequential delivery

Pumping scheme for Sr

**3P_0 \rightarrow ^1S_0** transition in a magnetic field (88Sr)

DC magnetic field mixes \( ^3P_0 \) and \( ^3P_1 \) m=0- states


Level scheme

Partial Hamiltonian

Eigenspace and shifted frequency

Induced decay rate and frequency shift

Required homogeneity of the magnetic field

Presence of moderate inhomogeneous broadening does not influence on the lasing significantly!

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It means here: typical duration of the superradiation pulse should be less than inverse inhomogeneous broadening.

Required homogeneity of the magnetic field over the value of the magnetic field

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