Stimulated raman adiabatic passage in optomechanics

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Propositions

accompanying the thesis
Stimulated Raman Adiabatic Passage
in Optomechanics

1. It is not possible to achieve high state-transfer efficiency in a not sideband resolved optomechanical system via STIRAP.

Chapter 3 of this thesis.

2. Fractional STIRAP can be used to distinguish between an entangled state and a statistical mixture.

Chapter 4 of this thesis.

3. It is much easier to align a Fabry-Perot optical cavity to a single mode optical fiber by maximizing the first cavity mirror back-reflected light into the fiber, and afterwards positioning the second cavity mirror, than the alignment by using a periscope to the fixed cavity mirrors.

Chapter 5 of this thesis.

4. In a ground state cooling experiment, the heating of the membrane in an optical cavity by absorption of the light might be higher due to the resonant probe light field than due to the strong cooling light field itself.

Chapter 7 of this thesis.

5. In a proposal to realize STIRAP in optomechanics Garg, et al. claimed to consider excitation transfer between two membranes in an optical cavity for feasible experimental parameters. Their analysis, however, is done in the limit of fully-reflective membranes, which is rather unrealistic while membranes have typical reflectivities around 0.1.

D. Garg, et al.,
Physical Review A 96, 023837 (2017)

6. In an article "Direct observation of deterministic macroscopic entanglement" the authors produced some highly-correlated state as they call it in the text. This state is not very useful as it has unknown complicated composition in the phonon basis, and therefore quickly decays.

S. Kotler, et al.,
Science 372, 622–625 (2021)

7. The work of R.Riedinger suggests that quantum mechanics is valid for picogram macroscopic objects. The decoherence time of the demonstrated superposition was inline with the standard quantum mechanics and 23 orders of magnitude short to test the possible gravity-induced decoherence.

R.Riedinger, et al.,
Nature 556, 473–477 (2018)

8. In the not too distant future advanced optomechanical systems can improve the sensitivity of the Laser Interferometer Gravitational-Wave Observatory to the point that a black hole merger would be detected every minute.

M.Page, et al.,
Commun Phys 4, 27 (2021)

9. Optomechanical systems are so clean that one may often expect the agreement between experiment and no-free-fitting-parameters quantum theory to be within a few percent accuracy.

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