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Saturation-induced bistability in strontium atoms interacting with an optical cavity

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We study the interaction between a cloud of ultracold strontium atoms and the light modes of an optical ring cavity laser-pumped near a forbidden atomic transition. In our cavity 0.1 photons are enough to saturate the narrow transition, which enables us to study saturation-induced effects even on resonance without being hampered by spontaneous emission. Furthermore, with the cavity decay rate exceeding by far the rate of spontaneous emission, we are in the so-called 'bad cavity' limit. The number of interacting atoms is sufficiently high to reach the strong collective coupling regime, where the energy exchange exceeds the energy loss rate, resulting in a characteristic normal-mode splitting of the cavity transmission spectrum. When the cavity was pumped sufficiently strong, however, our measured transmission spectra revealed the presence of a third peak near the atomic resonance, which has not been observed before. We were able to explain this peak as being due to saturation induced bistability caused by a nonlinear interaction between the Autler-Townes effect and normal-mode splitting. (1-3)

Palavras-chave: Quantum optics. Bistability. Nonlinear effects.

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Referências:

- 1 GRIPP, J.; MIELKE, S. L.; OROZCO. Evolution of the vacuum Rabi peaks in a detuned atom cavity system. **Physical Review A**, v. 56, n. 4, p. 3262-3272, 1997.
- 2 GOTHE, H.; VALENZUELA, T.; CRISTIANI, M.; ESCHNER, J. Optical bistability and nonlinear dynamics by saturation of cold Yb atoms in a cavity. **Physical Review A**, v. 99, n. 1, p. 013849-1-013849-5, Jan. 2019.
- 3 KARMSTRAND, T. *et al.* **Unconventional saturation effects at intermediate drive in a lossy cavity coupled to few emitters**. 2021. Disponível em: <https://arxiv.org/pdf/2110.00595.pdf>. Acesso em: 23 jan. 2023.