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LETTER

Optical bistability and multistability via electron injection rate in an imperfect cavity

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Abstract

In this letter, we investigate the electron injection rate-based optical bistability (OB) and optical multistability (OM) features in an imperfect cavity. Coherent optical fields interact with the open four-level quantum system that makes up the ring cavity. We have discovered that the threshold of OB and OM as well as the length of the hysteresis loop can be changed by varying the length of the quantum system, reflection and transmission coefficient of cavity mirrors. Our findings further show that the electronic exit rate from the cavity and the electron injection rates have a significant impact on the threshold of OB and OM. It is discovered that transitioning from OB to OM or vice versa is achievable by adjusting the controllable parameters. The impact of the cooperation parameter on the properties of the OB and OM is then addressed. The findings demonstrate that the OB features are simple to manipulate. Our suggested model might be used to develop an all-optical device for use in upcoming quantum information processing.

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