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Optical phonon lasing in transport through semiconductor double quantum dots RIN OKUYAMA, MIKIO ETO, Faculty of Science and Technology, Keio University, TOBIAS BRANDES, Institut fur Theoretische Physik, Technische Universitat Berlin — We theoretically propose optical phonon lasing for a double quantum dot (DQD) fabricated in a semiconductor substrate. No additional cavity or resonator is required. We show that the DQD couples to only two phonon modes that act as a natural cavity. The pumping to the upper level is realized by an electric current through the DQD under a finite bias. Using the rate equation in the Born-Markov-Secular approximation, we analyze the enhanced phonon emission when the level spacing in the DQD is tuned to the phonon energy. We find the phonon lasing when the pumping rate is much larger than the phonon decay rate, whereas anti-bunching of phonon emission is observed when the pumping rate is smaller. Both effects disappear by an effective thermalization induced by the Franck-Condon effect in a DQD fabricated in a suspended carbon nanotube with strong electron-phonon coupling. [1]

[1] R. Okuyama, M. Eto, and T. Brandes, arXiv:1205.6955 (2012).

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