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Nonlinear Fano effect in semiconductor quantum dots: Detecting weak interactions ALEXANDER GOVOROV, Ohio University — The Fano interference effect appears when a discrete state of an atom or quantum dot couples with a continuum of states. In self-assembled quantum dots, the coupling may come from the tunnelling or Auger processes [1,2,3]. This study develops a theory of Fano effect in self-organized quantum dots under the condition of strong optical pumping. Our theory shows that the Fano effect becomes greatly enhanced in the nonlinear regime. In the linear regime, if the dot-continuum interaction is very weak, the optical detection of Fano effect is impossible because of the Heisenberg principle. In other words, in the linear regime, a finite lifetime of an exciton creates an energy uncertainty and the Fano interference effect becomes invisible. However, in the nonlinear regime, the natural radiative broadening does not play the main role and even a very weak dot-continuum interaction becomes apparent. This nonlinear method can be used to detect very weak interactions between a two-level system (or qu-bit) and a continuum of states of any nature. The nonlinear Fano effect in InGaAs quantum dots has been observed in the recent experiments performed in Munich and Edinburgh [3]. This study was performed in collaboration with: W. Zhang, M. Kroner, K. Karrai, and R. J. Warburton. [1] A.O. Govorov, R. J. Warburton, and K. Karrai, Phys. Rev. B RC, 67, 241307 (2003). [2] K. Karrai et al., Nature 427, 135 (2004). [3] M. Kroner et al., submitted to Nature.

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