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Control of transverse optical patterns in semiconductor quantum well microcavities[1] M.H. LUK, Y.C. TSE, Physics Department, Chinese University of Hong Kong, N.H. KWONG, College of Optical Sciences, University of Arizona, P.T. LEUNG, Physics Department, Chinese University of Hong Kong, S. SCHUMACHER, Physics Department, University of Paderborn, R. BINDER, College of Optical Sciences and Department of Physics, University of Arizona — Recently, a low intensity all optical switching scheme exploiting directional optical instabilities in a semiconductor quantum well microcavity was proposed. It was demonstrated numerically that a sufficiently strong laser (pump) beam normally incident on the microcavity can suffer directional instabilities, generating new beams in oblique directions. These off-axis beams form a pattern when projected onto a plane in the far field placed transverse to the pump. Furthermore, the numerical results showed that the azimuthal orientation of the transverse optical pattern can be reversibly switched by applying a control beam much weaker than the pattern intensity. These phenomena are mediated by the nonlinear interactions among elementary excitations of the microcavity — polaritons formed from strong coupling between the quantum well excitons and photons in a cavity mode. In this Contribution, we provide an overview of the rich parametric dependencies of pattern selection, the time scale of pattern formation, and the switching process. We also present an analysis of system's dynamics based on the contributing polariton wave-mixing processes.

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