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Intersubband polariton bleaching observed in ultrafast mid-infrared spectroscopy SIMONE ZANOTTO, RICCARDO DEGL'INNOCENTI, JI-HUA XU, Scuola Normale Superiore and CNR-NANO, GIORGIO BIASIOL, Laboratorio TASC and CNR-IOM, LUCIA SORBA, ALESSANDRO TREDICUCCI, Scuola Normale Superiore and CNR-NANO — Strong coupling between intersubband transition in quantum wells and microcavity field leads to the concept of intersubband (ISB) polaritons. Their linear properties have been explored for several years, mainly focusing on optical spectra and electroluminescence. Among the implemented microcavity geometries, the one based on a photonic crystal (Zanotto et. al., Appl. Phys. Lett. 2010) is paricularly interesting as it allows simultaneous access to both polariton branches at anticrossing. Here we report on the nonlinear response of ISB polaritons, investigating their bleaching, an effect already studied in the excitonic framework. When ISB polaritons are probed by an intense mid-infrared laser pulse, the typical double-peaked transmission spectrum is converted in a single-peaked one. By tuning the intensity of the femtosecond pulse that covers both polariton branches, the whole range between weak and strong coupling regimes has been swept. This study reveals that there is a threshold for pumping above which polariton states are destroyed, and restricts the pump intensity range that can be employed in an optically-pumped ISB polariton laser. Moreover, as a consequence of nonlinear optical properties, saturable absorbers and optically bistable devices could be implemented.

Simone Zanotto
Scuola Normale Superiore and CNR-NANO

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