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Thermalization and condensation dynamics of a photon Bose-Einstein condensate

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We present time-resolved studies of the thermalization and condensation process of a two-dimensional photon gas in an optical microcavity. In our experiment, a two-dimensional photon gas is confined in a high finesse microresonator containing a dye medium. If this system is operated in a regime in which reabsorption of cavity photons by the dye medium dominates over photon loss, e.g. by mirror transmission, a thermalization process of the photon gas to the temperature of the resonator (room temperature) takes place. In earlier work, we have experimentally observed both the thermalization process and, at sufficiently high photon densities, a condensation in the resonator ground mode. In recent experiments, we have studied the thermalization and condensation dynamics of the system after excitation with a short laser pulse. The timescale on which the photon gas becomes thermal (Bose-Einstein distribution) is found to be in the picosecond to nanosecond regime and is tunable by various system parameters e.g. by the dye concentration. Upon spatially displacing the pump spot from the optical axis, a transient laser-like oscillation of higher order cavity modes can be observed. These laser-like oscillations decay after several hundred picoseconds when the majority of photons have relaxed to the resonator ground state.

Biography

Jan Klaers completed his PhD in 2011 at the University of Bonn (Germany) where he is currently working as a Postdoctoral researcher. He is known for his work on photon Bose-Einstein condensation which has been selected as one of the major physics breakthroughs in 2010 by the editors of *Physics Today* and *Physics World*.

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