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Quantum Dynamics of Photon Condensates PETER KIRTON, JONATHAN KEELING, University of St Andrews — Recent experiments have, for the first time, been able to observe the Bose condensation of a gas of weakly interacting photons. We develop a full out-of-equilibrium quantum mechanical treatment of the dynamics of this system. Our model consists of a series of photon modes coupled to the background dye molecules which we simply treat as two-level systems in which each level is separated into a ladder of rovivibration states. We find that the behavior of the photon field is very much like that of a two-level laser in which there is an asymmetry between the effective pump and decay rates induced by the rovivibrational states of the dye. This motivates us to use techniques based on those for the inversionless two-level laser. We are able to calculate the coherence properties of the photons as well as giving insights into the thermalization processes which equilibrate the populations of the various photon modes.

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