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Characterisation of the quasi-stationary state of an impurity driven by monochromatic light

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We study rigorously a pumping scheme of a solid state laser model starting from a microscopical model, which is composed of an impurity in a crystal interacting with a monochromatic external light source. The crystal-impurity interaction is assumed to be translation analytic and the external light source is of moderate strength in a specific sense. We prove for the effective dynamics the existence of and relaxation to a quasi-stationary state, which is a stationary state up to small Rabi oscillations due to the external light source. Moreover, we characterise the state in terms of “generalised Einstein relations” of spontaneous/stimulated emission/absorption, which are conceptually related to the phenomenological relations derived by Einstein in 1916. Our approach is based on a spectral analysis of the evolution semigroup pertaining to the nonautonomous Cauchy problem.

This is joint work with J.-B. Bru (Ikerbasque) and W. de Siqueira Pedra (Mainz).

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