Studies on the Rabi Model

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We report our recent studies on the quantum Rabi model (QRM). Firstly, by using a variational wave function, which facilitates to extract physics in entire parameter regime with high accuracy, we unveil a ground-state phase diagram of the QRM and argue that the main constituents are polaron and anti-polaron. Secondly, introducing an anisotropy into the QRM, in which the rotating- and counter-rotating terms are allowed to have different coupling strength, so that the model interpolates between two known limits with distinct universal properties. Through a combination of analytic and numerical approaches we compute phase diagram, scaling functions and critical exponents, and establish that the universality class at the finite anisotropy is the same as that of the isotropic limit. Our findings are relevant to a variety of systems that are able to realize strong coupling between matter and light.

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