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Active measurement-based quantum feedback for preparing and stabilizing superpositions of two cavity photon number states[1] YVES BERUBE-LAUZIERE, Univ of Sherbrooke — The measurement-based quantum feedback scheme developed and implemented by Haroche and collaborators [Dotsenko et al., Phys. Rev. A 80, 013805 (2009) and Sayrin et al., Nature 477, 73-77 (2011)] to actively prepare and stabilize specific photon number states in cavity quantum electrodynamics (CQED) is a milestone achievement in the active protection of quantum states from decoherence. This feat was achieved by injecting, after each weak dispersive measurement of the cavity state via Rydberg atoms serving as cavity sensors, a low average number classical field (coherent state) to steer the cavity towards the targeted number state. This talk will present the generalization of the theory developed for targeting number states in order to prepare and stabilize desired superpositions of two cavity photon number states. Results from realistic simulations taking into account decoherence and imperfections in a CQED set-up will be presented. These demonstrate the validity of the generalized theory and points to the experimental feasibility of preparing and stabilizing such superpositions. This is a further step towards the active protection of more complex quantum states than number states. This work, cast in the context of CQED, is also almost readily applicable to circuit QED.

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