Stace and Barrett Reply: Our recent work [1] considered a system consisting of a charge qubit coupled to a point contact (PC) charge detector in the relatively unexplored parameter regime of arbitrary detector bias, and $\Gamma_d \ll \phi$, where Γ_d is the measurement-induced dephasing rate of the detector upon the qubit, and ϕ is the qubit energy splitting. Describing the *conditional* evolution of the system in this parameter regime is particularly interesting in light of recent experiments [2–4], in which phenomena such as partial localization of an electron in the energy eigenstates of a double well system have been observed. Previous theoretical analyses of the conditional dynamics of this system [5,6] have been restricted to the limit of large detector voltage bias, $eV \gg \phi$, where, in the steady state, localization does not occur. On the other hand, our analysis is valid for *arbitrary* detector bias, since it properly takes account of qubit relaxation processes due to inelastic tunneling in the detector.

In [1] we made a number of predictions about the unconditional and conditional dynamics in both the high- ($eV > \phi$) and low-bias ($eV < \phi$) regimes. In their Comment [7], Averin and Korotkov (AK) take issue with one of these predictions: our claim that coherent oscillations are absent in the detector output. In this Reply, we acknowledge that, in the high-bias regime, this specific claim was inaccurate. We clarify the origin of this error and establish that other results in [1] are correct.

AK presume that the discrepancy stems from incorrect assumptions. For instance, they assert that our work "assumes that the qubit interaction with the PC detector suppresses quantum interference between qubit energy eigenstates." This leads AK to incorrectly imply that, in [1], the qubit decoheres on a time scale ϕ^{-1}, rather than the much longer Γ_d^{-1}. Furthermore, they assert that our expression for the current [Eq. (9) of [1]], containing three "jump" operators, follows by assumption. In fact, we made no such assumptions, as we now show.

The quantities computed in [1] follow naturally from our master equation, which is derived from a microscopic model. As in previous analyses of this system [6], we derive an unconditional master equation (UME), employing a Born-Markov approximation which assumes factorized initial conditions and rapid relaxation of the environment (PC leads). We then make a rotating wave approximation (RWA), which gives the most significant term in an expansion in $\Gamma_d/\phi \ll 1$. This results in a UME with three Lindblad superoperators. The RWA implies a temporal coarse graining, restricting our analysis to time scales longer than ϕ^{-1}. Solving the UME reveals that the qubit decoheres over a time scale $\Gamma_d^{-1} \gg \phi^{-1}$ [Eq. (10) of [1]].

We proceed to "unravel" the UME to produce a conditional master equation (CME), capable of describing the dynamics of the qubit conditional upon the stochastic measurement results. The CME must be consistent with the UME, so it follows that the CME has three jump operators, arising from the three Lindblad superoperators. Thus the number of jump processes is *not* an arbitrary assumption, as AK claim, but is a necessary consequence of the UME in the limit $\Gamma_d \ll \phi$, for any finite value of eV/ϕ. In [1] the particular form of the CME is determined by physical considerations, such as energy conservation. It can also be derived directly from an explicit measurement model [8], in which the temporal coarse graining on time scales $> \phi^{-1}$ is made explicitly.

Thus our work is valid only for time scales longer than ϕ^{-1}. Our high-bias power spectrum, $S_{\rm hb}(\omega)$, is therefore only valid for low frequencies, $\omega \ll \phi$, and so ought not be used at frequencies around ϕ. This constitutes the error in [1], rather than any of the criticisms of AK.

In the low-bias regime, $eV < \phi$, the UME predicts that the qubit relaxes to the (pure) ground state, $|g\rangle$. Since $|g\rangle$ is stationary, there should be no oscillatory signal in the PC current, and no peaks in $S_{\rm lb}(\omega)$ should be seen. This conclusion is in agreement with findings in [9].

In summary, we now believe our claim that coherent oscillations in the detector output are absent is not justified in the high-bias regime, $eV > \phi$, since our RWA only strictly applies for time scales longer than ϕ^{-1}. In the low-bias regime, $eV < \phi$, we believe that coherent oscillations are not observable, in agreement with [9]. The remainder of our conclusions are valid. Furthermore, our approach provides an accurate description of continuous measurement on time scales longer than ϕ^{-1}, in the operationally relevant regime of finite detector bias.

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