Devoret, Martinis, and Clarke Reply: It is of course true that, as Silvestrini[1] states, our data "do not represent an unambiguous proof of MQT." An experiment cannot prove a theory, but only invalidate an alternative theory. Our experiment was thus designed to compare measurements of escape rates with the classical and quantum theories without any adjustable parameters.

Silvestrini[1] suggests that Fig. 2 of our paper[2] should be reinterpreted as showing that $T_{\rm esc}^{(30)}(T) = T_{\rm esc}^{(14)} + 15$ mK. Here, $T_{\rm esc}^{(30)}$ and $T_{\rm esc}^{(14)}$ are the escape temperatures for a Josephson junction with crossover temperatures ($T_{\rm cr}$) of 30 and 14 mK, respectively. Silvestrini states that this equation is incompatible with the predictions of macroscopic quantum tunneling (we agree) but consistent with classical theory.

Silvestrini's claim is based on his Fig. 1, which he has redrawn from our paper[2] *without including any error bars.* Figure 1 shows $T_{\rm esc}(T)$ vs T on a linear scale including error bars (the horizontal error bars are taken from Fig. 13 of our later paper[3]). Also drawn are the predictions of the quantum theory[4] for the two values of $T_{\rm cr}$, and the predictions of the classical theory. We emphasize that both the experimental and theoretical results contain *no fitted parameters*; the relevant junction parameters were obtained in separate experiments in the classical regime. We observe that the values of $T_{\rm esc}^{(30)}$ are in extremely good agreement with the predictions of the quantum theory, and lie well above the classical predictions for $T < 50$ mK.

As we pointed out in our original Letter,[2] we wished to show that the observed flattening of the $T_{\rm esc}^{(30)}$ data did not arise from spurious noise sources that could present a higher effective temperature to the junction than the bath temperature. Accordingly, we lowered I_0 with a magnetic field to reduce $T_{\rm cr}$ to 14 mK, and remeasured $T_{\rm esc}^{(14)}$. The reduced I_0 was somewhat temperature dependent, resulting in a relatively large, *systematic* uncertainty in the values of $T_{\rm esc}^{(14)}$. When one takes into account the error bars, the data are not inconsistent with classical predictions. We have never made strong claims for the precision of the $T_{\rm esc}^{(14)}$ data; we wished only to show that at the lowest temperatures $T_{\rm esc}$ was reduced to rule out the possibility of spurious noise effects. Thus, the 15-mK offset above 30 mK shown in Silvestrini's Fig. 1 arises from the $T_{\rm esc}^{(14)}$ data, and *not* from a disagreement between the $T_{\rm esc}^{(30)}$ data and the MQT predictions.

For some reason, Silvestrini has chosen not to refer to three other independent pieces of evidence for quantum behavior. First, in Fig. 3 of our paper[2] we showed that the dependence of $T_{\rm esc}^{(30)}$ on the bias current at 19 mK was consistent with the quantum theory and inconsistent with the classical theory. Second, using microwave spectroscopy, we demonstrated the existence of quantized energy levels in the well, in complete contradiction with classical behavior.[3] Third, in a subsequent experiment,[5] we showed that the effects of dissipation in a particular junction reduced the escape rate by a factor of about 300, in very good agreement with quantum predictions.

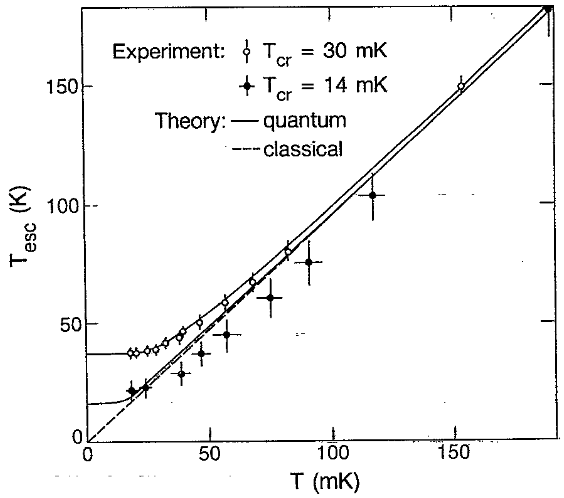

FIG. 1. Experimental and prediced values of $T_{\rm esc}$ vs T for a junction with $C = 6.35 \pm 0.4$ pF shunted with a measured line resistance of 190 ± 100 Ω. The values of I_0 were 9.489 ±0.007 μA for $T_{\rm esc}^{(30)}$ and approximately 1.383 μA for $T_{\rm esc}^{(14)}$.

We believe that our data for $T_{\rm esc}^{(30)}$ in Fig. 1 strongly disprove the classical theory and are consistent with the quantum theory. Our three other observations lead to the same conclusion.

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