Erratum: Single-Electron Tunneling with Strong Mechanical Feedback [Phys. Rev. Lett. 93, 136802 (2004)]

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We have discovered an unfortunate error in our recently published Letter [1]. Namely, we erroneously omitted a term in the right-hand side of Eq. (5) that reads

$$-\frac{F}{M\Gamma_t^3}\left(\Gamma^{0\to 1}\frac{\partial}{\partial x}\Gamma^{1\to 0}-\Gamma^{1\to 0}\frac{\partial}{\partial x}\Gamma^{0\to 1}\right)\frac{\partial}{\partial v}(vP). \tag{1}$$

This term has a clear physical meaning of a friction force acting on the mechanical part of the system. This force arises from electron tunneling and efficiently dumps the oscillator. For a tunneling through a single level, this force is proportional to $\delta(\tilde{W}-Fx)$ and only occurs once the amplitude is so big that the oscillator is driven below the current threshold. This was the reason for the erroneous omitting of this term. However, the friction is effective at the threshold. As a result, the distribution function $P(E)$ for infinitely large quality factor Q is constant for $E<\tilde{W}^2M\omega_0^2/F^2$ and decreases rapidly for higher energies. In other words, the oscillation amplitude ζ grows as long as $\tilde{W}-F\zeta$ does not reach the threshold, and is stabilized afterwards. The scale W_c is determined by this dissipation term, and happens to be $F^2/\omega_0^2M=\hbar\lambda\omega_0\ll\hbar\omega_0$. For such small scales our classical description is not applicable, and thus the mechanical motion in this regime does not renormalize transport properties of a single-electron tunneling device. Similar conclusions are drawn for tunneling through continuum of levels. We conclude that the regime of strong mechanical feedback described in the Letter never takes place for the models considered.

The model in use was rather restrictive, since no energy dependence of the tunnel matrix elements was taken into account. Such dependence is certainly present in more realistic circumstances. We have found that for more realistic models under certain conditions, the regime of strong mechanical feedback does occur. Strong current renormalization and enhanced current noise typical for this regime can be described within the same formalism as in the Letter provided the friction force is taken into account.

[1] Ya. M. Blanter, O. Usmani, and Yu. V. Nazarov, Phys. Rev. Lett. **93**, 136802 (2004).

