Reply to "Comment on 'Ehrenfest times for classically chaotic systems' "

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We maintain that the time scale that governs the quantum-to-classical crossover, in the sense that interference effects are suppressed for shorter times, depends logarithmically rather than algebraically on $\hbar$.

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In our paper [1] we calculated the Ehrenfest time [2] $\tau_E \propto \ln(1/\hbar)$ beyond which the Wigner function loses its classical interpretation of a phase space density in the limit $\hbar \to 0$. Tomsovic and Heller maintain [3] that the time scale for the breakdown of semiclassics increases algebraically rather than logarithmically with $1/\hbar$.

It appears to us that the issue is basically one of terminology. The use of a semiclassical approach on algebraically long time scales (like in the papers cited in Ref. [3] and in earlier papers [4]), requires inclusion of quantum interference effects that do not have a classical analog. The Ehrenfest time, however, refers to a stricter quantum-to-classical correspondence; namely, it is the time until which one may ignore the effects of quantum mechanical interference. This is what is relevant for the physics of shot noise and weak localization (Ref. 13 in our paper). It is well established that $\tau_E \propto \ln \hbar$, although there is no consensus on the coefficient of proportionality (which was the topic of our work). The algebraic time scale considered by Tomsovic and Heller is irrelevant for these transport properties.

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[2] G.P. Berman and G.M. Zaslavsky, Physica A **91**, 450 (1978).
[3] S. Tomsovic and E.J. Heller, Phys. Rev. E **68**, 038201 (2003), preceding paper.
[4] D.L. Shepelyansky, Dokl. Akad. Nauk (SSSR) **256**, 586 (1981) [Sov. Phys. Dokl. **26**, 80 (1981)]; V.V. Sokolov, Theor. Math. Phys. **61**, 1041 (1984).