Nonlinear Sciences > Chaotic Dynamics

# Statistical Approach to Quantum Chaotic Ratchets

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*(Submitted on 15 Mar 2010)*

The quantum ratchet effect in fully chaotic systems is approached by studying, for the first time, \emph{statistical} properties of the ratchet current over well-defined sets of initial states. Natural initial states in a semiclassical regime are those that are \emph{phase-space uniform} with the \emph{maximal possible} resolution of one Planck cell. General arguments in this regime, for quantum-resonance values of a scaled Planck constant $\hbar$, predict that the distribution of the current over all such states is a zero-mean Gaussian with variance $\sim D\hbar^{2}/(2\pi^{2})$, where $D$ is the chaotic-diffusion coefficient. This prediction is well supported by extensive numerical evidence. The average strength of the effect, measured by the variance above, is \emph{significantly larger} than that for the usual momentum states and other states. Such strong effects should be experimentally observable.

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| Comments: | REVTEX4, 13 pages, 4 figures |
| Subjects: | **Chaotic Dynamics (nlin.CD)**; Statistical Mechanics (cond-mat.stat-mech); Quantum Physics (quant-ph) |
| Journal reference: | Physical Review E 81, 036210 (2010) |
| DOI: | 10.1103/PhysRevE.81.036210 |
| Cite as: | **arXiv:1003.2995v1 [nlin.CD]** |

## Submission history

From: Itzhack Dana [view email]
**[v1]** Mon, 15 Mar 2010 19:14:59 GMT (28kb)

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