**Novaes, Marcel**

**Statistics of time delay and scattering correlation functions in chaotic systems. II: Semiclassical approximation.** (English) Zbl 1322.81049

J. Math. Phys. 56, No. 6, 062109, 14 p. (2015).

The scattering properties of a quantum mechanical, chaotic cavity with $M$ open channels can be described by its scattering matrix $S(E)$ which is an energy dependent, complex $M \times M$ matrix. In this article, the correlation function

$$C_n(\epsilon, M) := \frac{1}{M}\left\langle \mathrm{Tr}\left[S^\dagger\left(E - \frac{\epsilon\hbar}{2\tau_D}\right) S\left(E + \frac{\epsilon\hbar}{2\tau_D}\right)\right]^n \right\rangle,$$

where $\tau_D$ is the classical dwell time and $\langle \bullet \rangle$ denotes the average over $E$, is studied for a system without time reversibility and a semiclassical approximation is calculated. This calculation is based on a semiclassical approximation of the scattering matrix which takes into account a systematic pairing of classical trajectories and which has been established in physics literature [*R. A. Jalabert et al.*, Phys. Rev. Lett. 65, 2442 (1990); *K. Richter* and *M. Sieber*, Phys. Rev. Lett. 89, 206801 (2002); *S. Müller et al.* New J. Phys. 9, 12 (2007)].

From the semiclassical expression of $C_n(\epsilon, M)$, the author derives an expression for the energy averages of the time delay moments $\langle \mathcal{M}_m \rangle$ where $\mathcal{M}_m := \frac{1}{M}\mathrm{Tr}(Q^m)$ and $Q$ being the Wigner time delay matrix $Q := -i\hbar S^\dagger \frac{dS}{dE}$. The explicit expression of $\langle \mathcal{M}_m \rangle$ is of complicated nature. It is nevertheless possible to compare the expression for the first 8 moments ($m \leq 8$) to expressions which have been obtained by the author via random matrix theory [J. Math. Phys. 56, No. 6, 062110, 6 p. (2015; Zbl 1322.81050)] and show that they coincide.

Reviewer: Tobias Weich (Paderborn)

**MSC:**

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|---|---|---|
| 81Q50 | Quantum chaos | Cited in **1** Review |
| 81Q20 | Semiclassical techniques, including WKB and Maslov methods applied to problems in quantum theory | Cited in **4** Documents |
| 81U35 | Inelastic and multichannel quantum scattering | |
| 15B52 | Random matrices (algebraic aspects) | |
| 60B20 | Random matrices (probabilistic aspects) | |

**Keywords:**

time delay matrix; semiclassical approximation; scattering system

**Full Text:** DOI arXiv

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