

Sandro Wimberger & Georgios Kordas
Complex Dynamics in Quantum Systems
Institut für Theoretische Physik,
Universität Heidelberg
Philosophenweg 19, D-69120 Heidelberg
Email: s.wimberger@thphys.uni-heidelberg.de
g.kordas@thphys.uni-heidelberg.de
Phone: (+49-(0)6221) 54 - 9449
(+49-(0)6221) 54 - 9319



Tutorial on Quantum Chaos

nHS, Phil.weg 12, Wednesday 14:15 - 16:00 (SS 2012)

Problem Sheet 6

Problem 13 – Symplectic Matrices

A real $2n \times 2n$ matrix is called symplectic if:

$$M^T J M = J \quad \text{with} \quad J = \begin{pmatrix} 0 & -E \\ E & 0 \end{pmatrix}, \quad (1)$$

with the identity $n \times n$ matrix E .

Prove now the following statements:

- If M_1 and M_2 are symplectic then $M_1 M_2$ is symplectic.
- M is symplectic if and only if M is invertible with $M^{-1} = -J M^T J$.
- If λ is an eigenvalue of a symplectic matrix then also $1/\lambda$.
- 2×2 matrices have the property: M symplectic $\Leftrightarrow \det M = 1$.

Problem 14 – Lyapunov Exponent

Compute the Lyapunov exponent for the dyadic shift map (for its definition cf. problem 3 and the lecture).