

Homework Set # 9, due April 21, 2008

1. Consider the spectrum of a square box given by

$$E_{nm} = n^2 + \sqrt{(\pi/2)}m^2 \quad (1)$$

with m and n positive integers.

- a) Unfold the spectrum and make a histogram of the first 1000 spacings. Compare with the Poisson distribution.
 - b) Do the same for the levels between level number 10000 and 11001. Do you see any difference with a).
2. Consider an ensemble of hermitean 2×2 matrices given by

$$H \begin{pmatrix} a & c \\ c^* & b \end{pmatrix} \quad (2)$$

with a and b real and c complex. The unnormalized probability distribution is given by

$$P(H) = e^{\text{Tr}HH^\dagger}. \quad (3)$$

Determine the spacing distribution of this ensemble of random matrices and give a simple explanation of the small spacing behavior of your result.

3. Show that the Δ_3 statistic is related to the number variance $\Sigma^2(r)$ by

$$\Delta_3(L) = \frac{2}{L^4} \int_0^L (L^3 - 2L^2r + r^3)\Sigma^2(r)dr. \quad (4)$$

Is this relation invertible?