Robnik M., Dobnikar J. and Prosen T. **Energy level statistics in the transition regime between integrability and chaos for systems with broken antiunitary symmetry** J.Phys. A: Math. Gen. **32** 1427-1438 (1999)

Energy spectra of a particle with mass m and charge e in the cubic Aharonov-Bohm billiard containing around 10^4 consecutive levels starting from the ground state have been analysed. The cubic Aharonov-Bohm billiard is a plane billiard defined by the cubic conformal mapping of the unit disc pervaded by a point magnetic flux through the origin perpendicular to the plane of the billiard. The magnetic flux does not influence the classical dynamics, but breaks the antiunitary symmetry in the system, which affects the statistics of energy levels. By varying the shape parameter λ the classical dynamics goes from integrable ($\lambda = 0$) to fully chaotic ($\lambda = 0.2$; Africa billiard). The level spacing distribution $P(S)$ and the number variance $\Sigma^2(L)$ have been studied for 13 different shape parameters on the interval ($0 \leq \lambda \leq 0.2$). GUE statistics has proven correct for completely chaotic case, while in the mixed regime the fractional power law level repulsion has been observed. The exponent of the level repulsion has been analysed and is found to change smoothly from 0 to 2 as the dynamics goes from integrable to ergodic. This is precisely the analogy of the fractional power law level repulsion observed in the Poisson-to-GOE transition by Prosen and Robnik (1993,1994) and it thus differs essentially from the prediction of the random matrix theories. The semiclassical Berry-Robnik theory is expected to be correct in the ultimate semiclassical limit. However, we argue that the semiclassical regime has not been reached and give an estimate for the number of energy levels required for the Berry-Robnik statistics to apply.