

Statistics of local level spacings in quantum chaology

Peng Tian^a, Roman Riser^b, and Eugene Kanzieper^c

a Laboratoire J-A Dieudonné, CNRS, Université Côte d'Azur, France

b University of Haifa, Israel

c Holon Institute of Technology, Israel

Keywords: local level spacings, quantum chaology, random matrix, many-body systems, Riemann zeta function, SYK

We introduce a notion of local level spacings and study their statistics within a random-matrix- theory approach. In the limit of infinite-dimensional random matrices, we determine universal sequences of mean local spacings and of their ratios which uniquely identify the global symmetries of a quantum system and its internal – chaotic or regular – dynamics. These findings, which offer a new framework to monitor single- and many-body quantum systems, are corroborated by numerical experiments performed for zeros of the Riemann zeta function, spectra of irrational rectangular billiards and many-body spectra of the Sachdev-Ye-Kitaev (SYK) Hamiltonians.