Devil's staircase and modular invariance: from spectral statistics of random operators to phyllotaxis and the Hubbard model on a ring

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We discuss the spectral statistics of the 1D Anderson-like model with random hopping, paying attention to its relationship with some number-theoretic properties of the Riemann-Thomae function and the Dedekind eta-function exhibiting the ultrametric structure. We introduce the generalized Riemann-Thomae function and discuss its appearance in the problem of the repulsive particles packing on the cylinder (phyllotaxis). Also we show that the integral of the generalized Riemann-Thomae function has the Devil's staircase structure and coincides with the ground state of the Hubbard system of particles on a ring interacting with various long-ranged potentials.