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Hamiltonian Paths on Random Planar Maps

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Hamiltonian paths are self-avoiding random walks that visit all sites of a given lattice. We consider various configuration exponents of Hamiltonian walks drawn on random planar maps. Estimates from exact enumerations are compared with predictions based on the Knizhnik-Polyakov-Zamolodchikov (KPZ) relations, as applied to exponents on the regular hexagonal lattice. Astonishingly, when the maps are bipartite, a naive use of KPZ does not reproduce all the measured exponents, but an Ansatz may possibly account for the observed discrepancies. We further study Hamiltonian cycles on various families of bipartite planar maps, which fall into two universality classes, with respective central charges c = -1 or c = -2. The first group comprises maps of fixed vertex valency p larger than 3, whereas the second group involves maps with mixed vertex valencies, as well as a so-called rigid case. For each class, a universal configuration exponent and a novel critical exponent associated with long-distance contacts along a Hamiltonian cycle are predicted from KPZ and the corresponding exponent on regular (hexagonal or square) lattices. This time, the KPZ predictions are numerically confirmed by exact enumeration results for p-regular maps, with p = 3, 4, 5, 6, 7, and for maps with mixed valencies (2,3) and (2,4). The scaling limit of fully-packed systems thus poses intriguing unresolved questions from both the Liouville Quantum Gravity and the Schramm-Loewner Evolution perspectives. Based on joint works with Ph. Di Francesco, O. Golinelli and E. Guitter.

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