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Steps on Surfaces and Their Evolution: From Elementary Models to Universal Fluctuation Phenomena

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210 Robeson Hall

What does the time between buses in Cuernavaca have to do with step separations?

While steps on surfaces have many practical uses, they also offer remarkable, quantitatively measurable realizations of some familiar physical models. Step dynamics, e.g., can be viewed as a form of Brownian motion. After a survey of phenomena, I focus on the statistical properties of interstep separations on misoriented ("vicinal") surfaces. Such a terrace-width distribution (TWD) can be related to the spacings of repelling fermions evolving in one dimension. The TWD can then be analyzed simply in terms of undergraduate quantum mechanics and with more sophistication in terms of general properties of equilibrium fluctuations, viz. generalizations of the amazingly broadly applicable Wigner distribution from random-matrix theory. We go beyond equilibrium to describe step relaxation, growth, and capture-zone (Voronoi cell) distributions in island growth, with remarkable experimental implications.

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