Wind-tree models

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Abstract:

Wind-tree models are simplified 2D models for Boltzmann gases where a point-particle moves at constant speed with perfect bounces off rectangular obstacles in the plane. While Paul and Tatiana Ehrenfest initially considered randomly placed obstacles, J. Hardy and J. Weber introduced in the 1980s lattice-periodic wind-tree models, where the obstacles are placed at lattice points.

Like for random-walks, and more generally with infinite measure dynamical systems, many questions arise:

 * Does the particle come back near its starting point ? (recurrence versus transience)
 * How far the particle has gone up to time t ? (diffusion)
 * Does the particle goes everywhere ? (minimality and ergodicity)

The dynamics in these infinite billiards is naturally a Z^2 skew-product over translation flows. Using renormalization of translation flows (with the so-called "Teichmueller flow") all those questions have been recently answered.