

Abstract Submitted
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Mixing on a spherical shell by cutting and shuffling with non-orthogonal rotation axes¹ THOMAS LYNN, PAUL UMBANHOWAR, JULIO OTTINO, RICHARD LUEPTOW, Northwestern University — We examine a dynamical system that models the mixing of granular material in a half-filled spherical tumbler rotated about two horizontal alternating axes by using the machinery of cutting and shuffling through piecewise-isometries (PWI). Previous restrictions on how the domain is cut and shuffled are relaxed to allow non-orthogonal axes of rotation. Mixing is not only dependent on the amount of rotation used to induce mixing, but also on the relative orientation of the rotation axes. Well mixed regions within the PWI, which have a high density of cuts, typically interact with the periodic cutting boundary for both rotation axes. However, there are parameter combinations where the two rotations cut distinctly separate regions. The three-parameter space (a rotation about each axis and the relative orientation of the axes) is rich with detailed mixing features such as fractal boundaries and elliptic-like non-mixing regions.

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