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Axial Band Switching in Spherical Tumblers BRYAN LOCHMAN, PENGFEI CHEN, JULIO M. OTTINO, RICHARD M. LUEPTOW, Northwestern University — Axial band formation of bidisperse granular mixtures is typically studied in long cylindrical tumblers. Similar bands occur in spherical tumblers where there are no flat endwalls to initiate the bands. For a 50:50 mixture of large and small particles, three bands form: one at each pole and one at the equator. It is curious, though, that which particles appear in the equatorial band depends on the fill level of the tumbler. For low fill levels, large particles are at the equator; for high fill levels, the opposite occurs. The result is robust, occurring for several combinations of 1, 2, and 4 mm particles in a 140 mm diameter tumbler, though the fill level at which the transition occurs varies depending on particle size and rotational speed. Discrete element method simulations produce identical results. Particle tracking indicates that small particles flow further toward the poles than large particles in the upstream portion of the flowing layer for low fill levels leading to a band of small particles at each pole. The opposite is true for high fill levels, though the deviation between the paths for the small and large particles is smaller, resulting in slower segregation.

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