

G_2 and the rolling ball

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Date / Time / Location: Wed. May 23, 2012, 10:00 - 11:00, JD35.

Abstract:

The split real form of the exceptional group G_2 can be understood in two, distinctly different ways: as the automorphisms of the split octonions, or as the symmetries of one ball rolling on another without slipping or twisting, provided the ratio of radii is 1:3. We show that each of these descriptions secretly contains the other: on the one hand, the rolling ball system lives inside the imaginary split octonions as the space of 1d null subspaces. On the other hand, using geometric quantization and incidence geometry, we can recover the split octonions and their algebraic structure from the rolling ball system.