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Homotopical Complexity of Two Billiard Models.

We investigate the homotopical complexity of some billiard models. The first is a 3-D flat torus minus three mutually perpendicular, non-intersecting cylindrical scatterers, and the second is a 3-D flat torus with two mutually intersecting and mutually perpendicular scatterers. To describe the homotopical complexity, we construct subsets of the full homotopical rotations sets for each model. We then compute inner radial estimates for the these subsets and, thus, for the full homotopical rotation set. We also provide outer radial measurements for the full rotation set. The construction of orbit segments with prescribed homotopical itineraries utilizes the length minimizing variational method. (Received January 18, 2016)