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Helical growth trajectories in plant roots interacting with stiff barriers SHARON GERBODE, Physics Department, Cornell University, ROSLYN NOAR, MARIA HARRISON, Boyce Thompson Institute for Plant Research, Cornell University — Plant roots successfully navigate heterogeneous soil environments with varying nutrient and water concentrations, as well as a variety of stiff obstacles. While it is thought that the ability of roots to penetrate into a stiff lower soil layer is important for soil erosion, little is known about how a root actually responds to a rigid interface. We have developed a laser sheet imaging technique for recording the 3D growth dynamics of plant roots interacting with stiff barriers. We find that a root encountering an angled interface does not grow in a straight line along the surface, but instead follows a helical trajectory. These experiments build on the pioneering studies of roots grown on a tilted 2D surface, which reported "root waving," a similar curved pattern thought to be caused by the root's sensitivity to both gravity and the rigid surface on which it is grown. Our measurements extend these results to the more physiologically relevant case of 3D growth, where the spiral trajectory can be altered by tuning the relative strengths of the gravity and touch stimuli, providing some intuition for the physical mechanism driving it.

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