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Drag and lift forces in granular flows FRANÇOIS GUILLARD, OLIVIER POULIQUEN, YOËL FORTERRE, Aix-Marseille Universite, CNRS — Forces exerted on obstacles moving in a granular medium are studied both experimentally and numerically. The experiment consists in an horizontal cylinder rotating around a vertical axis in a granular media. Both drag forces and lift forces experienced by the cylinder are measured. The first striking result is obtained during the first half rotation, before the cylinder crosses its wake. Despite the symmetry of the object, a strong lift force is measured, about 20 times the buoyancy. The scaling of this force is studied experimentally and discussed in the framework of a continuum model based on a frictional rheology. The second striking observation is made after several rotations. The drag force dramatically drops and becomes independent of depth, showing that it no longer scales with the hydrostatic pressure. The rotation of the cylinder induces a structure in the packing, which screens the weight of the grains above.

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