Hydrodynamics approaches to granular matter

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Sand, rocks, grains, salt or sugar are what physicists call granular media. A better understanding of granular media is important - particularly when mixed with water and air, as it forms the foundations of houses and off-shore windmills. Until recently, there was no single theory that could account for granular media's flows at different speeds. Now, a new theory dubbed GSH, which stands for granular solid hydrodynamics, is supplementing previous models of granular material that work only for narrow speed ranges. And Yimin Jiang from Central South University, Changsha, China and Mario Liu from the University of Tübingen, Germany have now applied GSH to different experimental circumstances, for a wide range of flow speeds, in a study published in *EPJ E.*

Previously, granular media have been described using equations explaining how almost solid-like materials flow at low speeds, and how liquid-like or even gaseous materials flow at high speeds. In this study, the authors argue that the GSH theory is the most suitable choice for describing the complex behaviour of granular media, regardless of the flow speed, in a continuous manner.

GSH is based on equations used to describe hydrodynamic behaviour, and was initially applied to superfluid helium, as it behaves like a fluid with zero viscosity. It was subsequently applied to other complex fluids, e.g. liquid crystals by the 1991 Nobel Laureate Pierre-Gilles de Gennes. The trouble is that many scientists who have been studying granular media do not agree with the energy conservation principle or the validity

of the thermodynamics used in the GSH approach.

Despite such resistance, the authors then came up with the idea of adapting GSH to granular media. In this study, they apply the hydrodynamics equations to varying circumstances in a large collection of experiments with barely measurable, low and high flow rates.

More information: "Applying GSH to a Wide Range of Experiments in Granular Media." Y.. Jiang and M. Liu (2015), *European Physical Journal E* 38: 15, DOI: 10.1140/epje/i2015-15015-6

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