Physicists show way to count sweets in a jar -- from inside the jar

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(PhysOrg.com) -- How many sweets fit into a jar? This question depends on the shapes and sizes of the sweets, the size of the jar, and how it is filled. Surprisingly, this ancient question remains unanswered because of the complex geometry of the packing of the sweets. Moreover, as any contestant knows, guessing the number of sweets in the jar is difficult because the sweets located at the center of the jar are hidden from view and can't be counted. Researchers at New York University have now determined how sweets pack from inside the jar, making it easier to more accurately count them.

To answer the question of how particles pack in general, the NYU team made a transparent, fluorescent packing of oil droplets in water, which allowed it to record three-dimensional images and examine the local geometry of each member of the pack. In other words, what does a packing look like from the point of view of a grain within -- i.e., a "granocentric" view?

Their findings, which appear in the latest issue of the journal *Nature,* show that packing strongly depends on the size distribution—larger particles pack with more neighbors than do smaller ones. Nevertheless, the average number of contacts per particle always stays the same to preserve mechanical stability.

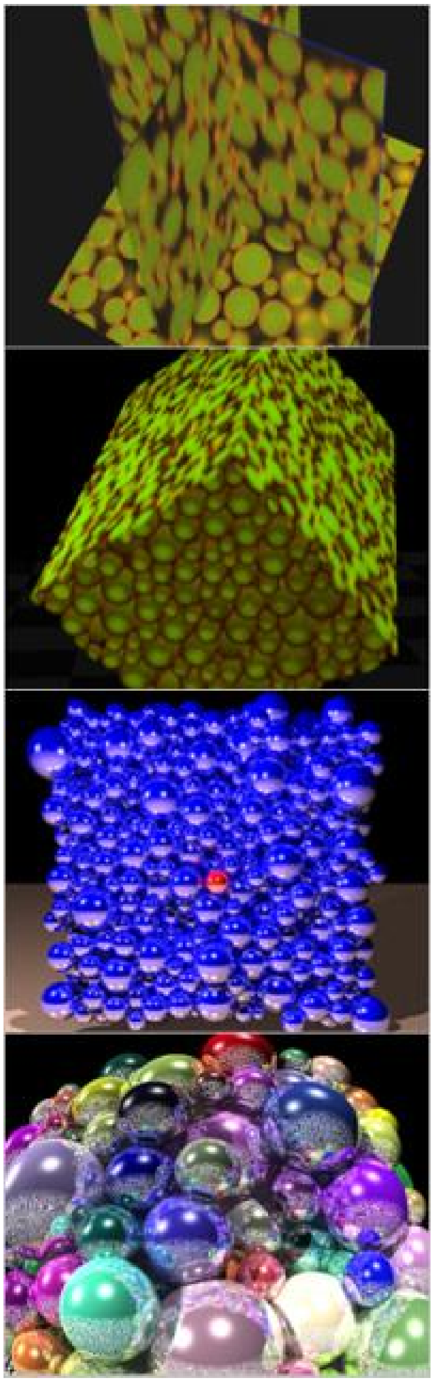

Photo Credit - Top Images: Brujic Lab; Bottom Images: Martin Lacasse

These experimental clues led the researchers to develop a model that successfully captures the geometry, connectivity, and density of the observed sphere packings. This means that starting from a set of particles of known sizes, the density of packing can be determined, making it possible to guess the number of sweets in the jar. Indeed, the model was able to also predict experimentally observed trends in density for mixtures of particles of two different sizes with varying ratios.

Packing problems are important in technological settings as well, ranging from oil extraction through porous rocks to grain storage in silos to the compaction of pharmaceutical powders into tablets. The ability to predict the packing of polydisperse particles—a range of sizes in a single system—has significant impact on these and related technologies.

Source: New York University (news : web)

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