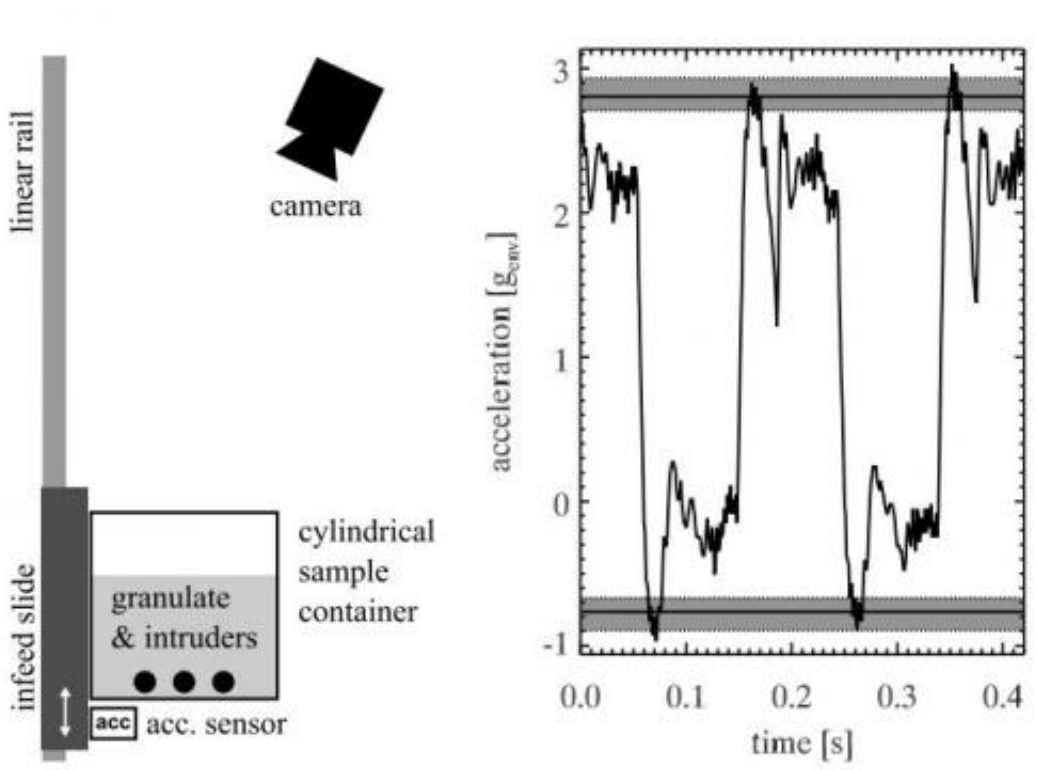
Researchers measure Brazil nut effect in reduced gravity

April 9 2013, by Bob Yirka



Left: Sketch of the experimental setup. The sample container is attached to an infeed slide, which can be moved vertically on a linear rail. Right: Acceleration profile of the infeed slide and the attached experiment container for an experiment with $g_{amb} = g_{Mars}$. Credit: arXiv:1304.0569 [cond-mat.soft]

(Phys.org) —A combined team of researchers from the Technical University of Braunschweig in Germany and Kobe University in Japan

has determined that the Brazil nut effect is less pronounced as gravity is reduced. The team describes tests they undertook both in the lab and as part of a simulated reduced gravity environment aboard an airplane in their paper they've uploaded to the preprint server *arXiv*, and the results they found after analyzing their observations.

The Brazil nut effect comes from the real world where the largest nuts in a can of mixed nuts—quite often Brazil nuts—tend to rise to the top of the container that holds them during transport. This occurs as the can is shaken—smaller nuts work their way down into smaller open areas, forcing larger nuts to rise towards the surface. The effect has been well studied under normal gravity conditions on Earth, but until now no one has thought to see how it might hold up under conditions such as those that are found on Mars or the Moon.

To find out, the researchers conducted experiments using glass beads rather than nuts—first in the lab, then aboard an A300 Airbus that was repeatedly allowed to descend rapidly enough to counteract the normal pull of gravity. In each case, large 8mm glass beads were put first in a container, followed by smaller 1mm glass beads. As different gravity conditions were met, the containers were shaken and the bead movement inside video recorded.

In analyzing the video, the researchers found that as gravity was decreased, the Brazil nut effect was reduced as well. The larger glass beads were more easily able to make their way to the top of the container under normal Earth gravity conditions than they were under reduced gravity conditions that simulated those found on the Moon and on Mars. They noted also that the change was roughly linear.

This research effort was not simply for curiosity's sake—gaining a better understanding of the Brazil nut effect on other bodies under different gravity conditions will likely help scientists gain a better understanding

of their underlying structure and could help with such future projects as mining expeditions. The researchers note that other factors could also come into play with the Brazil nut effect in other environments, such as cohesion between particles that could impact the outcome. More research will have to be done to find out if that is the case.

More information: Granular convection and the Brazil nut effect in reduced gravity, arXiv:1304.0569 [cond-mat.soft]
arxiv.org/abs/1304.0569

Abstract

We present laboratory experiments of a vertically vibrated granular medium consisting of 1 mm diameter glass beads with embedded 8 mm diameter intruder glass beads. The experiments were performed in the laboratory as well as in a parabolic flight under reduced-gravity conditions (on Martian and Lunar gravity levels). We measured the mean rise velocity of the large glass beads and present its dependence on the fill height of the sample containers, the excitation acceleration, and the ambient gravity level. We find that the rise velocity scales in the same manner for all three gravity regimes and roughly linearly with gravity.

Via TechnologyReview

Citation: Researchers measure Brazil nut effect in reduced gravity (2013, April 9) retrieved 18 April 2024 from https://phys.org/news/2013-04-brazil-nut-effect-gravity.html