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## ENGINEERING

### Micrometeoroid Impacts on Periodic Spacecraft Structures

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With the ever-increasing amount of space debris accumulating around the Earth, how can we protect spacecraft and satellites from collision damage? Our research seeks to explore the use of filled lattice structures to increase impact resistance of spacecraft while minimizing weight. Modern shielding methods are effective against some micrometeoroids and space debris. However, these shields are typically bulky and less effective against objects traveling at very high speeds.

CubeSats (miniature satellites used for space research) are especially at risk for impact damage, as their strict size and weight requirements prevent them from employing traditional shields. By using filled lattice structures developed by our team, spacecraft with size and weight requirements such as CubeSats will be better protected from these impacts without needing to make sacrifices to save weight.

Our team's basic experimental setup consists of tiny iron particles to simulate the micrometeoroids, a laser to push the particles, a lattice, and a high-speed camera. The laser induces motion in the particles by passing energy into them, and the particles' speed can then be measured with the camera. The particles impact the lattice, which is then examined for damage caused by particle impacts.

3-D modeling software is also used to support the experimental procedures of our research. It has not only made predicting and understanding experimental results possible, but it has also helped to produce a material study of lattice geometries for high-speed impacts that would be infeasible otherwise.

*Research advisor Vikas Tomar writes: "Research in meteorite impact at Purdue focuses on answering important questions such as: Can an important energy and communication system be protected from hypervelocity meteor impact? Can we design self-healing, damage-tolerant systems in space based on lab-scale hypervelocity impact experiments?"*

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