Students create bench-top particle accelerator to study effects of micrometeoroids

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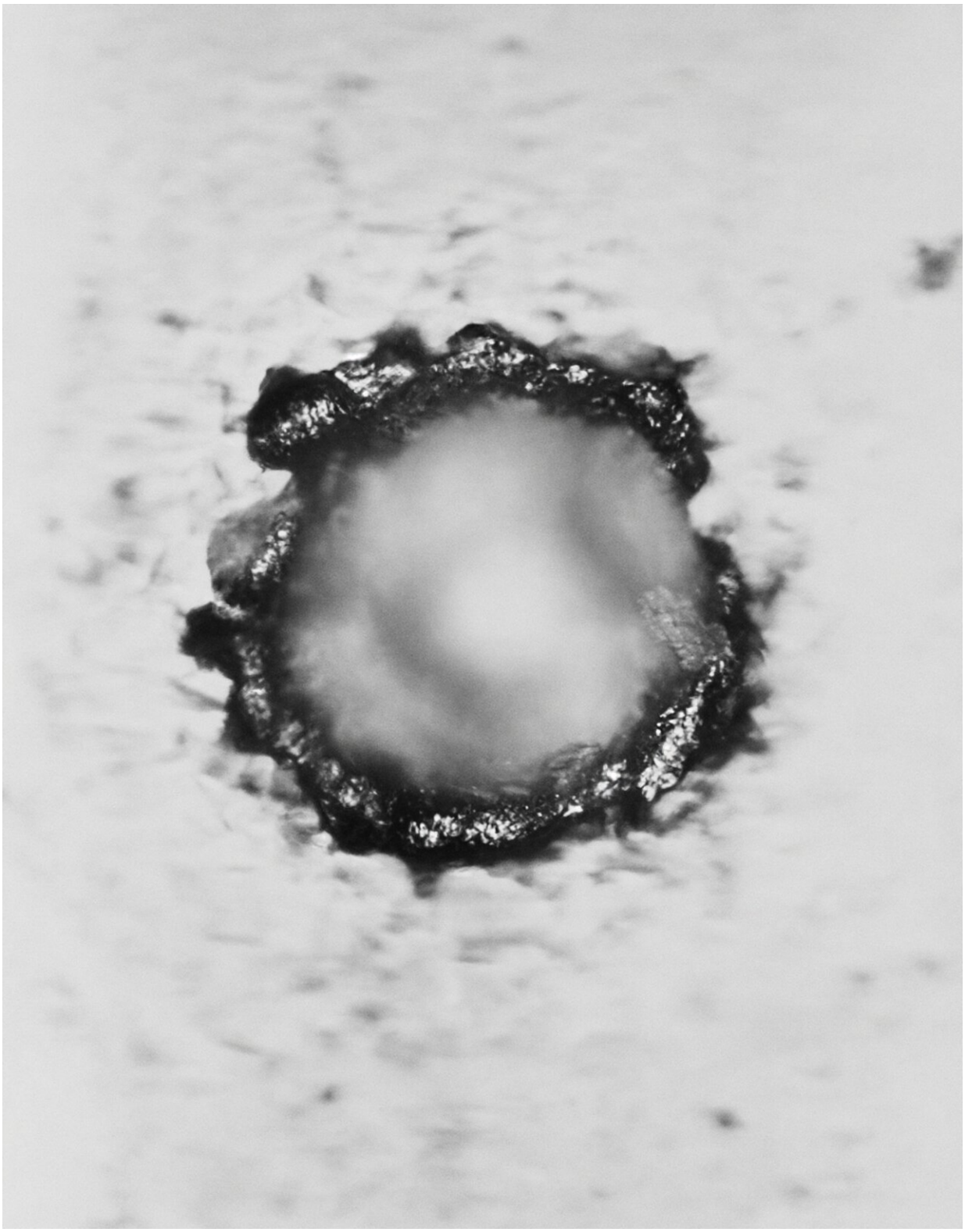

Single panel from micrometeorite package showing classic hypervelocity impact by micrometeorite particle. Crater is similar to that produced artificially on

Earth and by particle impacts on the lunar surface. Particles travel very fast in space and are typically small in size. This impact crater is less than one millimeter in diameter. Photo credit: NASA/CC0 Public Domain

A team of engineering students has recently developed and tested a bench-top particle accelerator they call LOKI, to test what happens to different materials when they are hit by micrometeoroids. The device, discussed in the *International Journal of Student Project Reporting* offers an innovative approach to controlled testing that could help in the design of spacecraft and satellites that face potential collisions with micrometeoroids as well as space debris.

Sabine Fuierer of Los Alamos National Laboratory in Los Alamos, and Noah Manz, Michael Hargather, and Paul Fuierer of the New Mexico Institute of Mining and Technology in Socorro, New Mexico, U.S., explain that LOKI can accelerate tiny particles to simulate the typical behavior of micrometeoroids. The device has the potential to accelerate these particles to speeds of up to almost kilometers per second in a vacuum, almost 14,000 km/h.

The students' initial tests have demonstrated they can achieve particle velocities of almost 12,000 km/h. They used high-speed videography to monitor particle velocities and observe their effects on different materials, including polyimide, used in space blanketing, and widely used plastic materials, such as acrylic. The team describes classic impact craters caused by the ultra-high-speed collisions on the surfaces of these test materials.

The team suggests that LOKI's practicality, flexibility, and cost-effectiveness could make it a useful tool for this kind of research. Indeed, they suggest that the cost per test would be just US$200. It

should allow researchers to assess the effects of micrometeoroid impacts on aerospace materials to be used in space applications including space exploration. The team points out that multiple impact sites with suitable separation distances can be tested in a single experiment, which benefits the requisite statistical analysis.

More information: Sabine Fuierer et al, Design of an explosive micro-particle accelerator to simulate micrometeoroid impacts in space, *International Journal of Student Project Reporting* (2023). DOI: 10.1504/IJSPR.2023.134223

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