

Swarms of dust-sized particles would explore planets

by Bend_Weekly_News_Sources

Engineers are designing a new breed of planetary explorers: tiny, shape-shifting devices that ride the wind like dust particles and also communicate, fly in formation and take scientific measurements. The specks might even be the first explorers from Earth to visit planets outside our solar system, the designers claim.

A "smart" dust particle would consist of a computer chip about a millimeter wide encased in a polymer material that wrinkles or smooths out when electrical activity occurs. Wrinkling the surface would increase air drag on the particle, making it float higher. Smoothing would cause it to sink. Swarms of so-called nano-nauts might be the first explorers from Earth on planetary systems outside our own, researchers say. Designers of the particles say they might be delivered to alien worlds via spacecrafts that use ion propulsion, a powering system that allows for slow but steady acceleration and efficient energy use. (Imagine courtesy Caltech) Simulations show that by switching between rough and smooth modes, the particles can gradually hop towards a target, even in swirling winds, researchers say.

"The concept of using smart dust swarms for planetary exploration has been talked about for some time, but this is the first time anyone has looked at how it could actually be achieved," said John Barker of the University of Glasgow, Scotland. He described possible applications of smart dust at the U.K. Royal Astronomical Society meeting in Preston, U.K. on April 18. "Computer chips of the size and sophistication needed to make a smart dust particle now exist," Barker said. "We are looking through the range of polymers available to find one that matches our requirements for high deformation using minimal voltages." The specks would use wireless networking to communicate and form swarms; "we envisage that most of the particles can only talk to their nearest neighbors but a few can communicate at much longer distances," Barker added. "In our simulations we've shown that a swarm of 50 smart dust particles can organize themselves into a star formation, even in turbulent wind." The ability to fly in formation would enable the chips to process information collectively and beam signals back to an orbiting spacecraft, he predicted. To be useful, the particles would need to carry sensors. Current chemical sensors tend to be rather large for the sand-grain sized particles that could be carried by the thin Martian atmosphere, Barker said. Venus, at atmosphere, on the other hand, is much thicker and could carry sensors up to a few centimeters in size, so these could theoretically be used there now. Meanwhile, "miniaturization is coming on rapidly," Barker noted. Chips available by 2020 will have components just a few nanometers (millionths of a millimeter) across, so that smart particles would be more like large molecules than dust grains, he argued. These would-be explorers are being dubbed nano-nauts. Barker's research group at Glasgow thinks it will be some years before smart dust is ready to launch into space, he said. "We are still at an early stage, working on simulations and components. We have a lot of obstacles to overcome before we are even ready to physically test our designs. However, the potential applications of smart dust for space exploration are very exciting. Our first close-up studies of extra-solar planets could come from a smart dust swarm delivered to another solar system."

Courtesy Royal Astronomical Society and World Science staff

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