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K. Randall
SETI Institute; krandall@seti.org
Tel.: 1-650-9604537

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More information: <http://cams.seti.org>

THE BIZARRE CASE OF METEORS WITH TWO IDENTITIES

Astronomers have discovered why we see meteors flash through the night sky while they seemingly rain down on us gently at the same time. In a paper published in the December 20 issue of the *Astrophysical Journal*, models of the zodiacal cloud are reconciled with radar observations, revealing a game of hide and seek and an interesting identity switcharoo.

"This detective story was much a case of meteors you can see and those you can't", says lead author and planetary astronomer David Nesvorny of the Southwest Research Institute in Boulder, Colorado.

Meteors are caused by meteoroids that hit the Earth's upper atmosphere at astronomical speeds, although some hit slower than others. Out in space, those meteoroids move feverishly between the planets. They are seen as a diffuse glow of scattered sunlight in the night sky, called the zodiacal cloud.

While zodiacal cloud models predict that meteoroids should hit Earth relatively gently, raining down the micro-meteorites that lace the Antarctic snow, radar observations of meteors consistently see the sky filled with rapidly speeding ones, too fast for anything to survive.

"How is that possible?", asked Nesvorny and his collaborators. "To reconcile things, we improved our model to predict meteor rates and took into account how radars are able to see meteors. And things worked!"

The new model showed that radars are nearly blind to slow meteors, but pick up just the right collection of fast meteors to explain what they see in nature.

One bizarre observation remained unexplained. Radars sensitive to small 100 micron sized sporadic meteors see the same speeds and approach directions as those sensitive to meteoroids ten times as big.

"That was a conundrum", says meteor astronomer and co-author Peter Jenniskens of the SETI Institute and NASA Ames Research Center. "Bigger particles should disappear more quickly. Instead, they seem to survive for about the same time."

In their new paper, Nesvorny and Jenniskens explain why: Meteoroids in the zodiacal cloud are born one way, and then turn into another after shedding most of their plumage.

Meteoroids are born from comets in a fragile form, prone to rapid destruction, most likely from heating and cooling in day-night cycles. These large centimeter-sized meteoroids cause the meteor showers we see at night. "Meteoroid streams don't seem to survive for more than a few thousand years", says Jenniskens.

They are broken into pieces a tenth to one millimeter in size that are observed as sporadic meteors by radar and as the diffuse zodiacal cloud in the night sky. It is those meteoroids that survive for almost 100,000 years before they are destroyed by collisions among themselves. "The radar data show that small and big ones are destroyed in this way at much the same rate", concludes Nesvorny.

Co-authors on the paper include radar astronomer Diego Janches of the Space Weather Laboratory at NASA Goddard Space Flight in Greenbelt Maryland, as well as planetary astronomers David Vokrouhlicky, Petr Pokorny, and William F. Bottke of the South-West Research Institute. This work was supported by the NASA Planetary Geology and Geophysics and Planetary Astronomy programs.