Airless space weathering duplicated in lab environment

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Using laboratory instruments typically used to make semiconductor devices, space weathering of airless bodies in the Solar System has been simulated, allowing researchers to better determine the ages of their surfaces, states a new paper by Kimberly R. Kuhlman of the Planetary Science Institute.

"'Space weathering' is a catch-all term for what happens to surfaces exposed to the environment of space over time. This includes the micrometeorite impact damage and redeposition, effects of UV radiation, and the effects of implantation of solar wind particles," said Kuhlman, lead author of "Simulation of solar wind space weathering in orthopyroxene" that appeared in *Planetary and Space Science*. "More space weathered surfaces become redder and darker from the formation of nano-scale particles of iron."

Bodies in the Solar System that exhibit space weathering include the Moon, Mercury and asteroids.

Kuhlman shot hydrogen atoms at solar wind speeds into tiny, polished samples of the common Solar System mineral orthopyroxene that had been placed on top of a silicon wafer. She then examined the compositional changes in the outer 20 nanometers of the implanted orthopyroxene using a scanning transmission electron microscope (STEM), and for the first time discovered the particles of iron beginning to form.

"This continuing work will allow us to estimate the rate at which these 'nanophase' iron particles form as a consequence of exposure to the solar wind. Linking this to the spectroscopic effects will allow scientists to infer the age of the body surfaces via remote sensing, which in turn will inform our understanding of a wide range of physical processes in the Solar System," Kuhlman said.

Provided by Planetary Science Institute