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Characterizing the Charging Properties of Lunar Dust is Critical to Returning to the Moon

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A love of physics

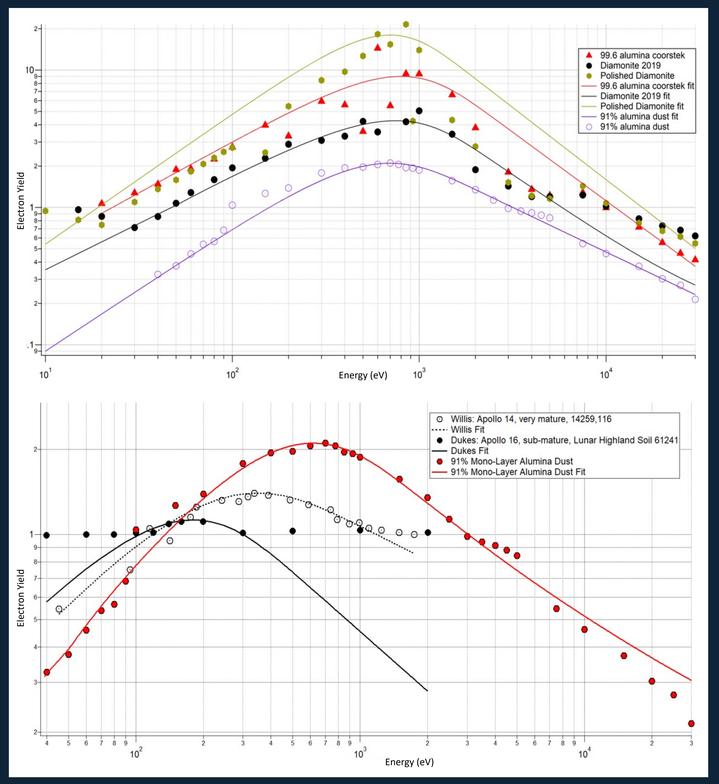
I am a senior majoring in physics with a double minor in mathematics and computer science.

I began researching the physics of materials at USU. I wanted to see how the concepts in the classroom were realistically used in the “real” world…*and beyond*.

Dust can do some serious damage

Dust in space is very sharp and retains charge for long periods of time. These particles can electrostatically adhere to many types of materials, tearing through and depositing charge onto their surfaces.

To prevent this damage, the fundamental properties of dust must be factored into spacecraft design. There have been previous attempts to characterize these properties, but with little success.



(Top) Electron yield values of dust compared to smoother surfaces. This means that granular samples are not entirely comparable to bulk surfaces of the same composition.
(Bottom) Electron yield data collected – red – compared to previous research – black and white. The black and white data points are all near 1 while the red data points are present over a much wider range of values, suggesting more reliable data.
(Left) Apollo 11 astronaut surrounded by lunar dust on the Moon.

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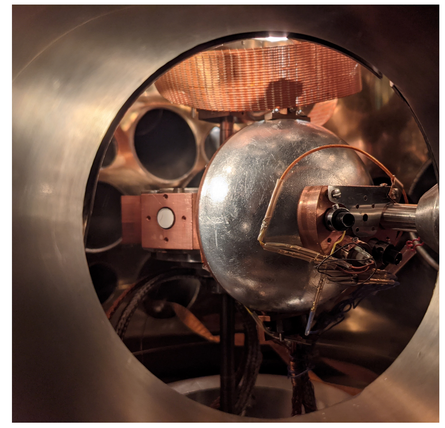
Building a unique system

Using our specialized facility at USU we are analyzing the charging properties of lunar dust simulants through electron yield measurement.

Significant effort went into increasing the sensitivity and performance of our facilities instrumentation to produce well-defined results. We developed a customized preparation and characterization method, redesigned and built unique charge dissipation instruments.



Promising results

We compared our lunar dust simulant electron yield data to a polished surface of the same material trying to ascertain if they exhibited the same charging properties. We found significant differences in the data sets, granular samples must be used for data collection, justifying our highly specialized methodology.

Our data is a good approximation for lunar dust, so we compared it to actual lunar dust results from previous literature and found an incredible improvement in data quality and reproducibility.