Using Onset Diameter to Predict Surface Composition of Charon

Upper Darby High School, 601 N Lansdowne Ave, Drexel Hill, PA 19026
Vince Tran, Sarah DeMott, Jack DiPrimo, Walidah Ghuman, Nikolas Gjidele, Elyas Himdi, Daniel McBride, Malachi Neal, Phi Nguyen, Max Peters, Catherine Vivo, Roseann Burns, Faculty Advisor

Objective
Indirectly find the surface composition of Charon by finding the ratio of onset diameter to surface gravity and comparing to ratios on other celestial bodies of known composition.

Simple vs Complex Craters
- Greater impact velocity causes a greater diameter.
- A simple crater is smooth and bowl-shaped while a complex crater has a central uplift.
- Simple craters generally have a smaller diameter than complex.

Onset Diameter vs Surface Gravity
- Onset diameter is the cutoff diameter between simple and complex craters.
  - Below onset diameter = simple crater
  - Above onset diameter = complex crater
- Onset diameter between a simple and complex crater correlates to the body’s surface gravity.
- Because the graph is logarithmic, there is a negative power relation between the two variables.
- Rocky bodies fall on a higher trendline than icy bodies.

Simple vs Complex Craters

Craters Analyzed
- Simple Craters
  - 411
- Complex Craters
  - 117
- Ambiguous Craters
  - 149

Diameter Ranges
- 1.0-15.6 km
- 8.6-230.0 km
- -----

Methods
- Consult the coordinate database provided by Stuart Robbins to locate craters on Charon.
- Find crater using JMARS, measure diameter, and visually determine whether it is simple or complex.
- Determine onset diameter ratio by using the following methods:
  - 50% transition - After sorted in 2.5km diameter ranges, when there is a greater number of complex than simple craters in a range.
  - Geometric mean - Geometric mean of crater diameters from the largest simple to the smallest complex.
  - 5th Percentile - Of all complex craters, the 5th percentile diameter.

Conclusion
- Charon has a surface gravity of 28.8 cm/s² and an onset diameter of 12.5 km, placing it below the trendline for icy bodies.
- Charon follows the icy bodies trend, suggesting that the composition of Charon is predominantly icy.

References
Figure 1. Impact Craters in the Solar System.