

Geological features of a saturnian small satellite, Helene: implications to the characteristics of E ring.

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Recent Cassini observations have provided numerous high resolution images even of small satellites, which happen to reveal their full varieties in terms of shapes and surface appearances. We are working especially geological aspects of these satellites because (1) there might be unknown processes working between small satellites and saturnian rings; (2) if so, understanding formational and evolutionary processes of saturnian satellites may hold important clues to understand those of Saturn system; and (3) small-sized bodies in solar system may have unique surface conditions as indicated by recent missions to small-sized asteroids, satellites, or comets. Also, comparatively very limited (or almost no) researches have been performed for such satellites despite their importance discussed above. Thus, we are trying to unravel specific characteristics of the surface and internal structure of each satellite. We will present initial results of our carefully studies of geological features of Helene, which is located in the E ring regions.

Helene, located at the Dione's leading Lagrangian point and known as one of saturnian trojan satellites, is a poorly-understood satellite with no previous geological studies. Therefore, we first study comprehensive research, such as a shape modeling, crater counting, and detail analyses of surface features. As a result, we find that these features vary widely by regions. For example, the leading hemisphere appears to have smooth surfaces with no small craters or streaky features, while sub-Saturn side of trailing hemisphere shows numerous craters close to saturated. Anti-Saturn side of trailing hemisphere has groove and a lot of craters with the intermediate density. Interestingly, large craters (over ~10km) are uniformly distributed. These crater distributions indicate that the entire bedrock of Helene is quite old and that small craters of leading hemisphere are erased. We conclude E ring materials have contaminated the surface of Helene's leading hemisphere, which resulted in the depletion of small craters as well as formations of streaky features. In addition, we conclude that streaky features are resulted from mass movements and are active even at present time.

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