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Abstract

In this paper, high-resolution Galileo images of Io are closely examined and correlation between surface ridges and tidal stress is carefully studied Galileo spacecraft ended its 14-year-long mission on Sep 21, 2003 Its exploration provided invaluable information for our understanding of Jupiter and its moons, in which Io is of main interest in this work The author rules out two possibilities for ridge formation by analyzing the observed images Firstly, the truncation of the ridges by the rim of patera indicates that the ridges are independent of volcanic and tectonic activity, since the ridges do not tend to have the same orientation as the patera wall Secondly, a comparison between the estimated threshold friction speed and calculated surface wind speed on Io makes it impossible that the ridges on Io are dunes similar to those on Earth and Mars The author further investigates the possibility of ridges formation by tidal stress It is very know that Io has tidal heating due to the proximity to its parent planet and the high eccentricity of its orbit As a result of this, variation of tidal bulge lead to heat dissipation and the surface of Io goes through a cycle of expansion and contraction This expansion/contraction cycle may cause tidal stress, forming ridges on the moon surface Greenberg et al (1998) provided a method of calculating tidal stress on Europa, the second inner moon from Jupiter Based on their method, model of tidal stress on Io is calculated by changing parameters such as orbital eccentricity, period and radius In order to show the change of magnitude and direction of stress over time, time series of tidal stress model in one orbital period are calculated for six different locations on Io Comparing the calculated stresses orientation with the observed ridges azimuth, the author notices that tidal stress near the equator tend to be oriented north-south and east west, so do the ridges located in that region The correlation between tidal stress orientation and ridge azimuth also holds for region at high latitude where they both have a more oblique angle This correlation between tidal stress and ridges give a clue for the study of ridge formation on Io In this paper, three mechanisms are speculated and briefly examined However, more observations and theoretical models are necessary for further conclusion

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