

The Solar System – Exercise classes

Problem Set 5

Distributed: 11 Nov 2024, results due: 18 Nov 2024.

Problem 5.1

Assume that each of the ten most active volcanoes on Io emits 50 km^3 of fresh material per year, spread evenly across the surface. At which rate (thickness per time) is new crust formed? How long does it take to cover the whole surface with a fresh layer of 1 km thickness? (2 points)

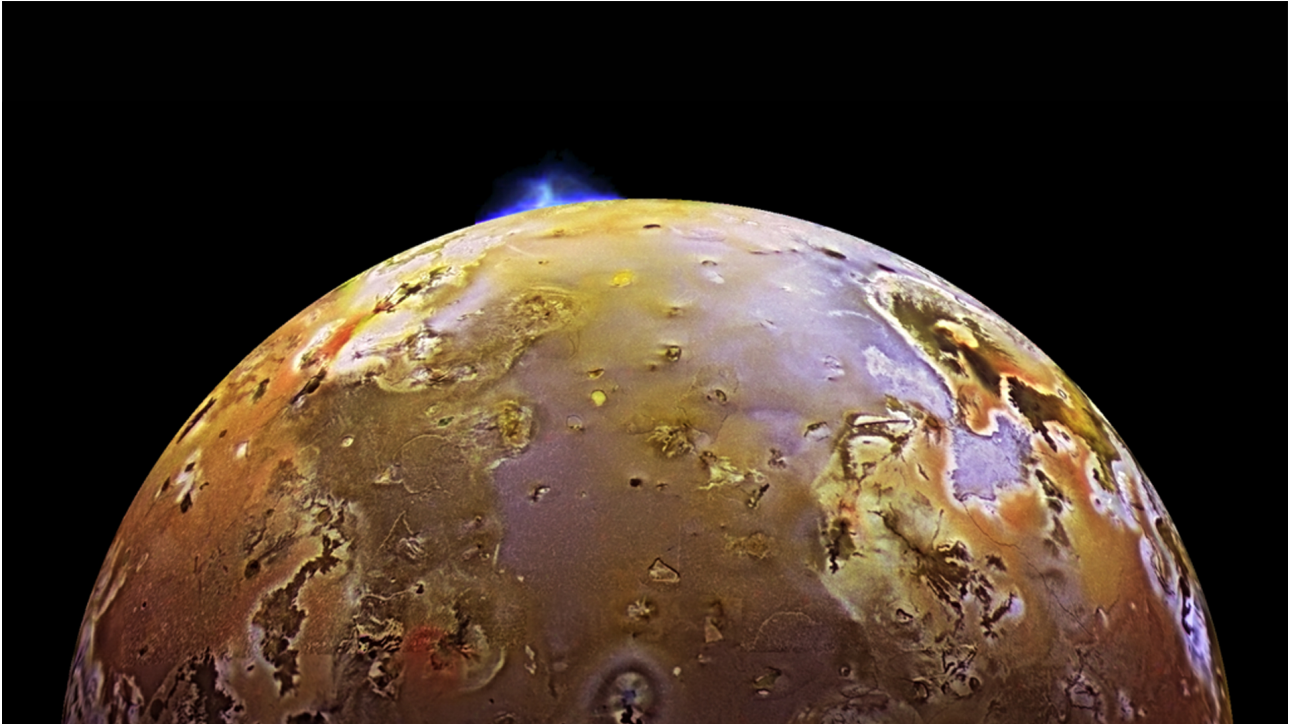


Figure 1: Volcanic activity on Jovian moon Io.

Problem 5.2

Earth's tectonic plates move, subduct, and resurface at a rate of a few centimeters per year. Estimate the time required to renew the surface of Earth completely. How does the result depend on the number of plates? (2 points)

Problem 5.3

Estimate the peak pressure induced in the ground by the impact of an object with a diameter of 1 km at 20 km/s. (1 point)

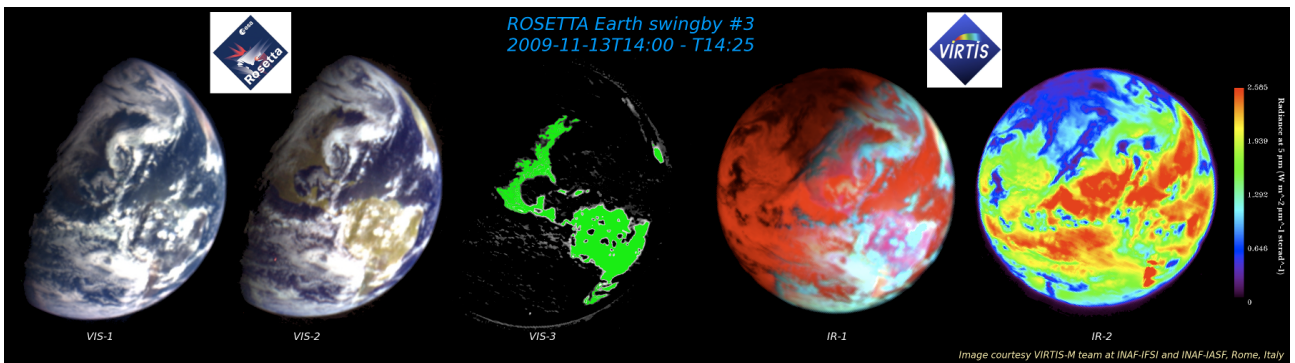


Figure 2: Views of Earth's western hemisphere taken by the VIRTIS instrument onboard the Rosetta spacecraft, covering a range of wavelengths from visible to mid-infrared light.
(Image credit: ESA, INAF-IFSI/INAF-IASF/ASI; details: <https://sci.esa.int/s/WmQ65oW>)