INNER SOLAR SYSTEM

A ringed Mars

Astrophys. J. Lett. **896**, L28 (2020)

The origin of the two small satellites of Mars, Phobos and Deimos, is still unclear. The hypothesis that they are captured small asteroids has been very popular for a long time, but an in situ formation after a giant impact has regained ground in recent years. However, the orbits of the two moons are difficult to explain via the giant-impact scenario: Phobos's lifetime, due to tidal disruption from Mars, is too short (~50 Myr) and Deimos, which is beyond the Mars-synchronous orbit, is drifting away. Matija Ćuk and colleagues show that a vastly different ancient Martian system, which included a massive ring around the planet 3–4 Gyr ago, can explain their current configuration.

The idea of a past ring around Mars connected to the formation of the satellites was presented by Hesselbrock and Minton (*Nat. Geosci.* **10**, 266–269; 2017), who suggested the presence of a repeating ring-satellite cycle, of which Phobos is just the latest product. Ćuk et al. use the peculiar inclination of Deimos — a tilt of almost 2° — to constrain this scenario via an *N*-body numerical simulation. According to their results, the current orbit of Deimos is explained by a 3:1 mean motion resonance with a long-gone inner satellite 20 times more massive than Phobos. Such resonance could only happen if this ancient moon were migrating outwards owing to interaction with a ring, which is consistent with the continuous cycle of ring-satellite formation put forward by Hesselbrock and Minton. In this scenario, Deimos is an almost primordial satellite, whereas Phobos was formed only relatively recently.

Luca Maltagliati

Published online: 8 July 2020
https://doi.org/10.1038/s41550-020-1162-8