

ASTRONOMY UNIT 24

Lab Four – Roche Limit

Questions

The Roche Limit or tidal radius is the distance from the center of a primary body where tidal forces exerted on satellite may deform or destroy the satellite. One of the theories on the origin of Saturn's rings is that they were created when a captured object got pulled into the tidal radius (Roche Limit) of Saturn.

Are there any moons inside Saturn's Roche Limit?

Hypotheses

1. There are no moons inside Saturn's Roche Limit
2. There is at least one moon inside Saturn's Roche Limit

Method

Calculate the Roche Limit for the Saturn orbital system using the following equation

$$d = 2.4 \times R (\rho_M / \rho_m)^{1/3}$$

d satellites orbiting the primary less than this radius may be torn apart by tidal forces

R_m is the radius of the Primary Object

ρ_M is the density of the Primary Object

ρ_m is the density of the satellite

Moon	Saturn Radius (km)	Saturn Density (gm/cm ³)	Moon Density (gm/cm ³)	Roche Limit (km)	Moon Orbit (km)
S/2009	58,000	0.7	1.2		117,000
Moonlets	58,000	0.7	1.2		130,000
Pan	58,000	0.7	1.2		133,584

Conclusion