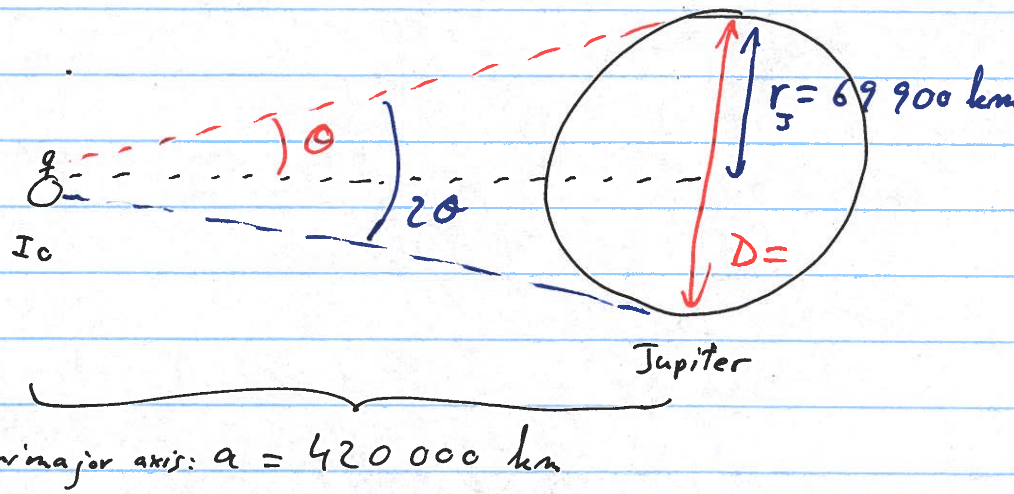
Friday, October 9, 2020

Angular size of Jupiter from Io:



$$\tan\theta = \frac{\text{rise}}{\text{run}} = \frac{\text{opposite}}{\text{adjacent}} = \frac{69\,900}{420\,000} = 0.16643$$

$$\Rightarrow \quad \theta = \arctan(0.16643) = 0.16492 \text{ rads}$$

$$= 9.449 \text{ degrees}$$

$\times \frac{180}{\pi}$

$$\Rightarrow \quad 2\theta = 2 \times 9.449$$

$$= 18.9 \text{ degrees}$$

$$= 37.8 \text{ "Moons"}$$

$\div$ 0.5 degrees (angular size of Earth's Moon)

The angular size of Jupiter as seen from Io is

$$2\theta = 18.9 \text{ degrees}$$

$$\approx 38 \text{ "Moons"}$$

Orbit of Io: what's Io's period?

$M_J = 1.898 \times 10^{27}$ kg

$a_{Io} = 420\,000$ km

$= 420\,000 \times 10^3$ m

$= 420 \times 10^6$ m

$$T^2 = \frac{4\pi^2}{G(M_J + M_{Io})} a^3 \simeq \frac{4\pi^2}{G M_J} a^3$$

(M_{Io}: neglect)

$$= \frac{4(3.1415)^2 (420 \times 10^6)^3}{(6.6743 \times 10^{-11})(1.898 \times 10^{27})}$$

$$= 2.309 \times 10^{10}$$

$\Rightarrow \quad T = \sqrt{2.309 \times 10^{10}} = 151954$ s

$= 1.76$ days

($\div (24 \times 3600)$)