

Celestial Body Parameters

Earth

- $GM_{Earth} = 398,600.435507 \text{ km}^3/\text{s}^2$
- Relevant average orbital parameters for the Earth relative to the Sun:
 - $a = 149,598,023 \text{ km}$
 - $e = 0.016708617$

Moon

- $GM_{Moon} = 4,902.800118 \text{ km}^3/\text{s}^2$
- Relevant average orbital parameters for the Moon relative to the Earth:
 - $a = 384,400 \text{ km}$
 - $e = 0.05490$

Sun

- $GM_{Sun} = 132,712,440,041.279419 \text{ km}^3/\text{s}^2$

Universal gravitational constant: $G = 6.67408 \times 10^{-11} \text{ kg}^{-1} \text{ m}^3 \text{ s}^{-2}$ (be careful of units!)

Sources:

- 1) Gravitational parameters from DE440 as described in Park et al., 2021, “The JPL Planetary and Lunar Ephemerides DE440 and DE441,” The Astronomical Journal, Vol. 161, No. 105.
- 2) G extracted from JPL Horizons webpage,
- 3) Orbital parameters from Vallado, D.A., “Fundamentals of Astrodynamics and Applications”, Fourth Edition, 2013, Microcosm Press, Hawthorne, CA.