

Solar gravitational field near Jupiter

Gravitational constant GM for the Sun

$$GM_S = 1.33 \times 10^{20} \text{ m}^3 / \text{s}^2$$

Sun-Jupiter distance

$$r_J = 7.78 \times 10^{11} \text{ m}$$

$$\begin{aligned} g_S &= \frac{GM_S}{r_J^2} = \left(\frac{1.33 \times 10^{20} \text{ m}^3 / \text{s}^2}{(7.78 \times 10^{11} \text{ m})^2} \right) \left(\frac{1 g_E}{980 \text{ m/s}^2} \right) \\ &= 224 \times 10^{-9} g_E \end{aligned}$$

In Jupiter's gravitational field

Gravitational constant GM for Jupiter

$$GM_J = 1.27 \times 10^{17} \text{ m}^3 / \text{s}^2$$

Juno's apojoive

$$r_a = 8.1 \times 10^9 \text{ m}$$

Juno's perijove

$$r_p = 75600 \text{ km}$$

$$\begin{aligned} g_{Ja} &= \frac{GM_J}{r_a^2} = \left(\frac{1.27 \times 10^{17} \text{ m}^3 / \text{s}^2}{(8.1 \times 10^9 \text{ m})^2} \right) \left(\frac{1 g_E}{980 \text{ m/s}^2} \right) \\ &= 197 \times 10^{-6} g_E \text{ at apojoive} \end{aligned}$$

$$\begin{aligned} g_{Jp} &= \frac{GM_J}{r_p^2} = \left(\frac{1.27 \times 10^{17} \text{ m}^3 / \text{s}^2}{(7.56 \times 10^7 \text{ m})^2} \right) \left(\frac{1 g_E}{980 \text{ m/s}^2} \right) \\ &= 22.7 g_E \text{ at perijove} \end{aligned}$$

$$\begin{aligned} v_p &= \sqrt{\frac{GM_J}{r_p}} = \sqrt{\frac{1.27 \times 10^{17} \text{ m}^3 / \text{s}^2}{7.56 \times 10^7 \text{ m}}} \\ &= 41 \text{ km/s at perijove} \\ &= 91714 \text{ mi/hr} \end{aligned}$$