

General Physics Notes (07172026):

Particle orbits are found from Euler-Lagrange EOMs in specific electromagnetic field geometries in the toroid constraints (for stellarator tokamak hybrid). Eventually, we'll need to bring B-splines into the computation for pixels and magnet control.

Some astro.

A space capsule has communications blackout on re-entry due to the shock-wave plasma. The operating frequency is $300MHz$. What is the minimum plasma density?

This is straightforward and we can apply the plasma frequency calculation (derived from linearization of course).

$$\omega_p^2 = \frac{n_0 q_e}{\epsilon_0 m_e} \quad (1)$$

Rewritten as...

$$n_0 = \left(\frac{\omega_p^2 \epsilon_0 m_e}{q_e} \right) \quad (2)$$

We know...

$$\begin{aligned} q_e &= 1.6 \cdot 10^{-19} C \\ \epsilon_0 &= 8.854 \cdot 10^{-12} \frac{F}{m} \\ m_e &= 9.1 \cdot 10^{-31} kg \end{aligned}$$

PLUG AND CHUG

$$n = \frac{m \epsilon_0 (2\pi f)^2}{q_e} \quad (3)$$

We find...

$$n = 9 \cdot 10^{14} m^{-3}$$

QED