

1. Debye shielding:

Consider a test charge q_t and compute the net charge of the Debye shielding cloud (Yukawa potential) as a function of radial distance measured in units of the Debye length.

2. Plasma properties:

(a) Calculate the electron thermal speed, Debye length, and the plasma parameter for

- a tokamak plasma with $T_e = 10^8$ K, $n_0 = 10^{19}$ m⁻³
- the tail magnetosphere with $T_e = 10^7$ K, $n_0 = 10^6$ m⁻³
- the ionosphere with $T_e = 10^3$ K, $n_0 = 10^{12}$ m⁻³
- the solar atmosphere with $T_e = 10^4$ K, $n_0 = 10^{20}$ m⁻³

(b) Compute collision frequency and mean free path for these plasmas.

3. Plasma definition

Can a fully ionized plasma be maintained at temperatures of $T_e = 100$ K (Hint: derive a condition for the density in relation to the temperature). How important is recombination for such a cold plasma?

Please turn in the solutions to the homework on Friday, 3/9/12