

Problem sheet 1

Plasma Physics course
TU Dresden
Lecturer: Katerina Falk
Summer semester April – July 2021

Question 1:

Compute λ_D and N_D for the following cases:

- A glow discharge, with $n = 10^{16} \text{ m}^{-3}$, $k_B T_e = 2 \text{ eV}$.
- The Earth's ionosphere, with $n = 10^{12} \text{ m}^{-3}$, $k_B T_e = 0.1 \text{ eV}$.
- A pinch plasma, with $n = 10^{23} \text{ m}^{-3}$, $k_B T_e = 800 \text{ eV}$.

Question 2:

In a strictly steady state situation, both the ions and the electrons will follow the Boltzmann relation:

$$n_{e,i} = n_0 \exp(q_{e,i} \phi / k_B T_{e,i})$$

For the case of an infinite, transparent grid charged to a potential ϕ , who that the shielding distance is then given approximately by:

$$\lambda_D^{-2} = \frac{ne^2}{\epsilon_0} \left(\frac{1}{k_B T_e} + \frac{1}{k_B T_i} \right)$$

Show that λ_D is determined. By the temperature of the colder species.