Háskóli Íslands
Verkfræðideild
Rafmagns- og tölvuverkfræði

Haust 2007

08.33.40 Hlutjónað rafgas

Dæmablað 6

Skilafrestur 16. október 2007 kl. 14:00

1. **Collisional Sheath Law**

   (15) Dæmi 6.4 í Lieberman og Lichtenberg

2. **Thermodynamics and Vapor Pressures**

   (15) Dæmi 7.5 í Lieberman og Lichtenberg

3. **Langmuir probe**

   (15) A cylindrical Langmuir probe with radius $a = 40$ μm and length $d = 63$ mm is used to determine the plasma density n_e and electron temperature T_e in an argon discharge. The plasma potential (with respect to ground) is measured to be 30 V. The Langmuir probe I versus V_B characteristic is measured to be (V_B is the probe voltage with respect to ground).

I [μA]	-25	- 22	- 19.3	- 14.8	- 8.7	15	50.5	131	313	733
V_B [V]	-20	-10	0	10	15	20	22.5	25	27.5	30

   (a) According to (6.6.29), a plot of I^2 versus $\Phi_P - V_B$ should be a straight line in the ion saturation regime $\Phi_P - V_B \gg T_e$. Plot I^2 versus $\Phi_P - V_B$ on linear scales for $\Phi_P - V_B \gg T_e$. Extrapolate the linear part of this curve to determine the ion saturation current I_i over the entire voltage range $0 < \Phi_P - V_B < 50$ V. Then apply (6.6.29) to I_i (where m in (6.6.29) is the ion mass) to determine n_s.

(b) Subtract I_i from I to determine the electron current I_e and plot $\ln I_\mathrm{e}$ (log scale) versus $\Phi_\mathrm{P} - V_\mathrm{B}$ (linear scale). You should obtain a straight line as in (6.6.6). Find T_e and n_s from your data. Compare the n_s value you find in part (a), and comment briefly on any discrepancy.