2007 Part 1 Q1

Exp

a. (i) Langmuir probe at constant potential

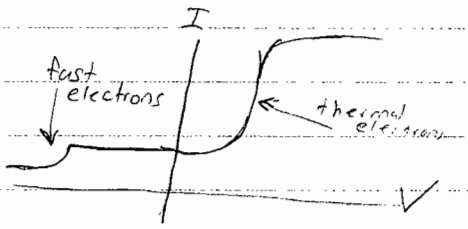
$I_{is} = 0.6\, A\, e\, n \sqrt{\frac{T_e}{m_i}}$ If T_e is known, density can be measured

At floating potential, $V_f \Rightarrow$ when $I_i + I_e = 0$

(ii) Voltage bias is swept: can measure e^- distribution function, or T_e for a Maxwellian. And V_p.

It should be swept from about $V_p - 6T_e$ to $V_p + T_e$. One doesn't want to exceed V_p by too much or else the flux of electrons to the probe may overheat it.

Small fast electron population:



b. Double probe: $I = I_{is} \tanh\left(\frac{eV_B}{2T_e}\right)$. You can measure T_e and density. Advantages are that the maximum current drawn to a probe is the ion saturation current

c. Triple Langmuir probe: One can measure V_f, T_e, density, (and thus V_{sp}).

Assumption: Maxwellian, does not change on spatial scale of probe separation.

Bias voltages: • for the floating double probe, $V_B >> \frac{T_e}{e}$.

• single probe, no bias (floating)