The modeling of the continuous emission spectrum of a dense non-ideal plasma in optical region

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The optical properties of dense plasma

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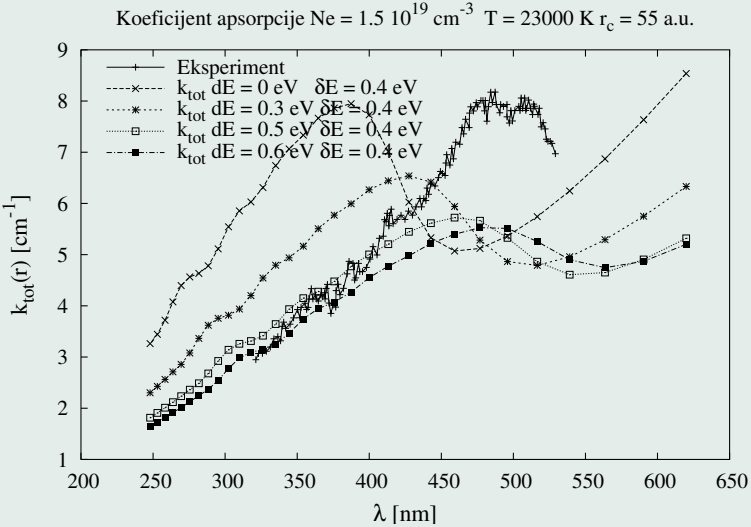
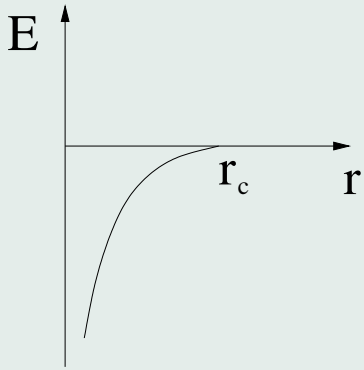
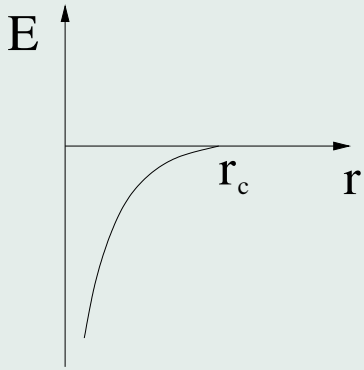



E
r
r_c



$$U(r) = \begin{cases} -\dfrac{e^2}{r} + \dfrac{e^2}{r_c} & : \quad 0 < r \leq r_c \\ 0 & : \quad r_c < r \end{cases} \tag{1}$$

$$\left\{ \frac{d^2}{dr^2} + \frac{2}{r}\frac{d}{dr} + \frac{2m}{\hbar^2}\left[E - U(r)\right] - \frac{l(l+1)}{r^2} \right\} R = 0, \tag{2}$$

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c) $e^2/r_c<E$

The bond states, case a)

$$P(r) = \begin{cases} C_N M_{\kappa,\mu}\left(\dfrac{2r}{a_0\nu^2}\right) & : \quad r < r_c \\ \sqrt{r} C_N C_{E,l} k_{l+1/2}\left(r\sqrt{-2mE/\hbar^2}\right) & : \quad r \geq r_c \end{cases} \tag{5}$$

Where $\mu = l+1/2$, $\nu = \sqrt{-\frac{e^2}{a_0}\frac{1}{2E_c}}$, $a_0 = \hbar^2/me^2$ and $E_c = E+e^2/r_c < 0$.

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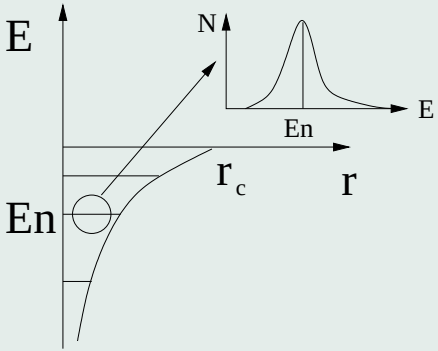
Free states, case b)

$$P(r) = \begin{cases} C_0 M_{\kappa,\mu}\left(\frac{2r}{a_0\nu^2}\right) & : \quad r < r_c \\ C_0 r\left[C_1 \frac{\sqrt{2mE}}{\hbar} j_l\left(\frac{\sqrt{2mE}}{\hbar} r\right) + C_2 \frac{\sqrt{2mE}}{\hbar} y_l\left(\frac{\sqrt{2mE}}{\hbar} r\right)\right] & : \quad r \geq r_c \end{cases} \tag{6}$$

Free states, case c)

$$P(r) = \begin{cases} C_0 F_l\left(\eta, r\right) & : \quad r < r_c \\ C_0 r \left[C_1 \frac{\sqrt{2mE}}{\hbar} j_l\left(\frac{\sqrt{2mE}}{\hbar} r\right) + \right. & \\ \left. C_2 \frac{\sqrt{2mE}}{\hbar} y_l\left(\frac{\sqrt{2mE}}{\hbar} r\right) \right] & : \quad r \geq r_c \end{cases} \tag{7}$$

Where $\eta = 1/\sqrt{2(E - 1/r_c)}$


E
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r
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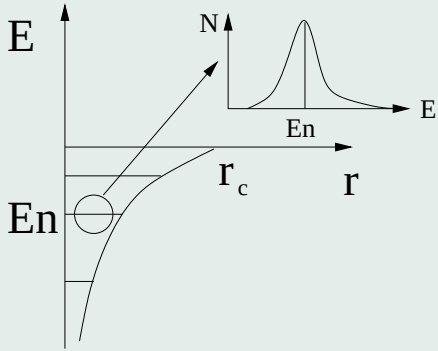
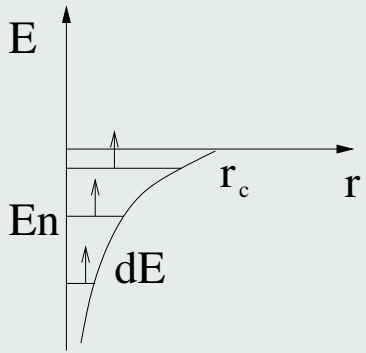


Lorentz:

$$\frac{\gamma}{2\pi}\frac{1}{(E-E_n)^2+\gamma^2/2} \tag{8}$$


E
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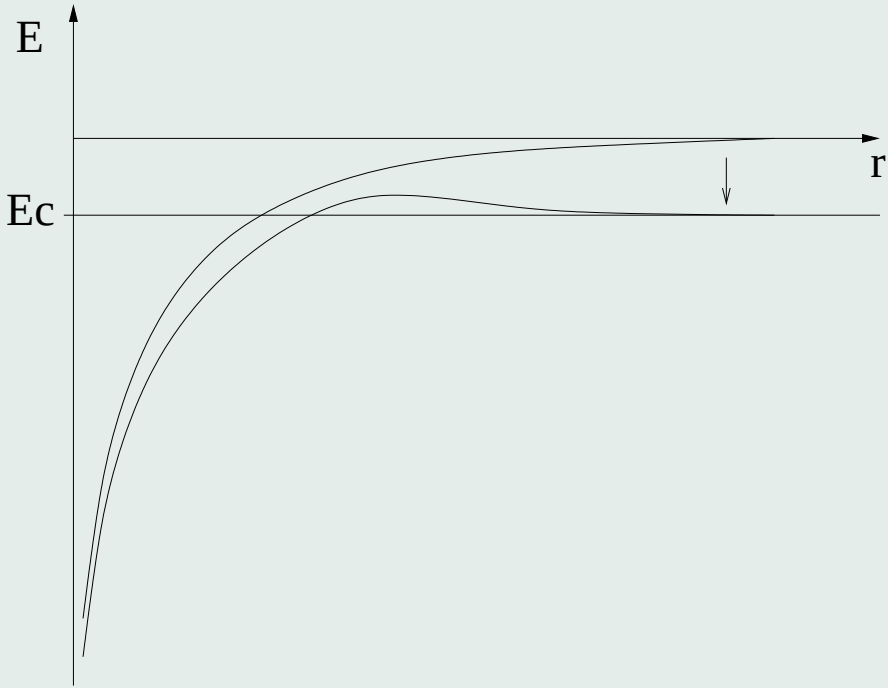
E
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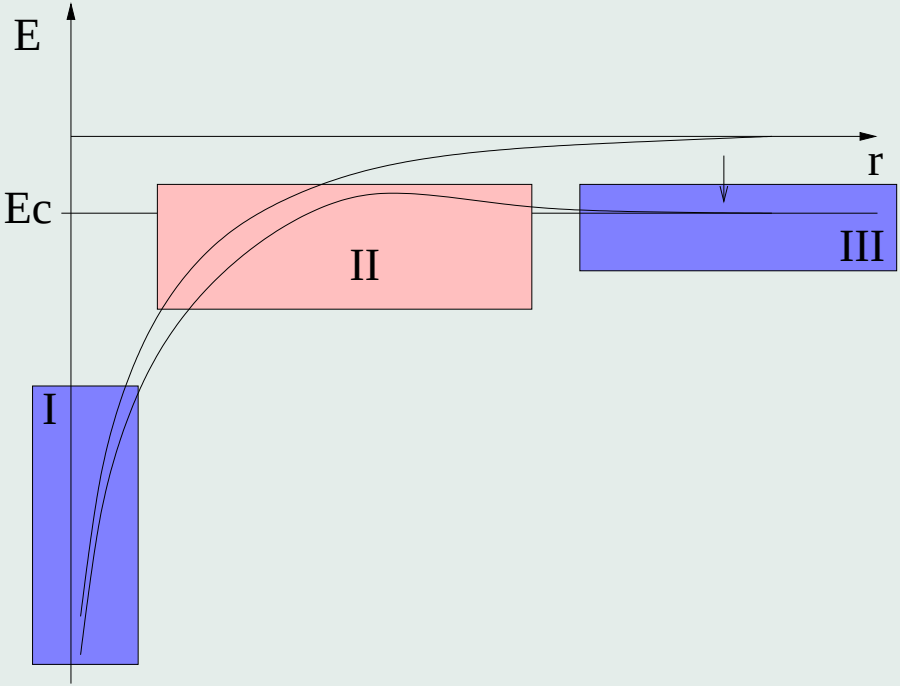
E
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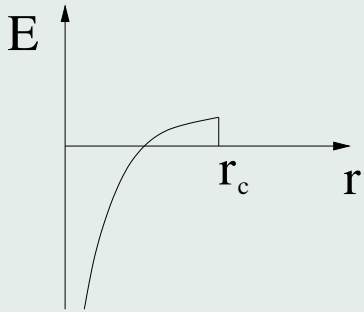
II
III
I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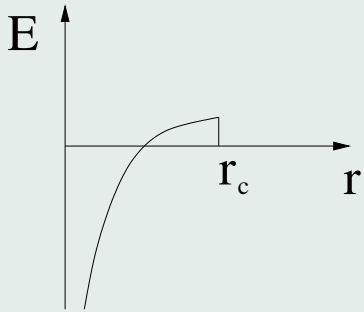

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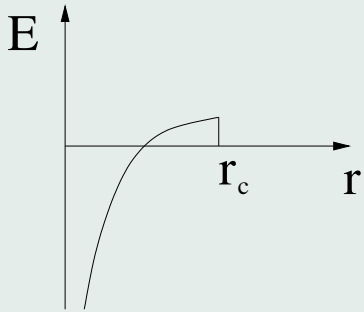

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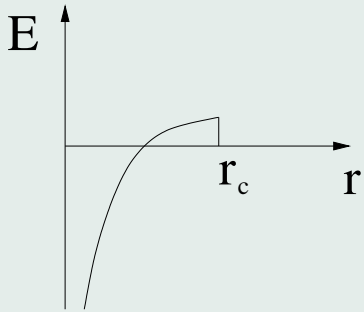

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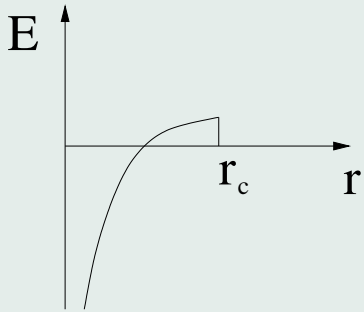

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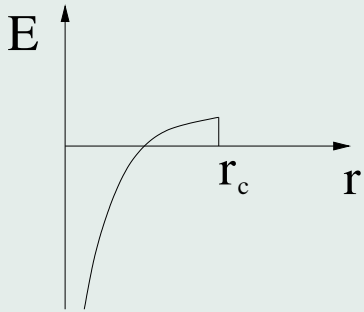

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Where $\eta = 1/\sqrt{2(E - k_{rc} 1/r_c)}$

Example of a shift

The parametar k_{rc} is set to be $5/2$

n	l	E_1 $[eV]$	E_2 $[eV]$
1	0	-13.1107	-12.3687
2	0	-2.90672	-2.16467
2	1	-2.90645	-2.16467
3	0	-1.01716	-0.275107
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3	2	-1.01683	-0.275047

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- Into the newly introduced QM model potential, the aditional shifting of a levels is a part of the model itself.