# 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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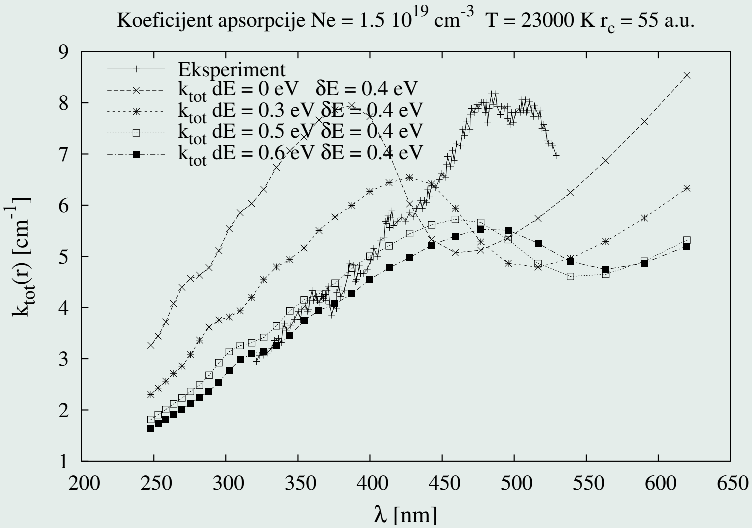
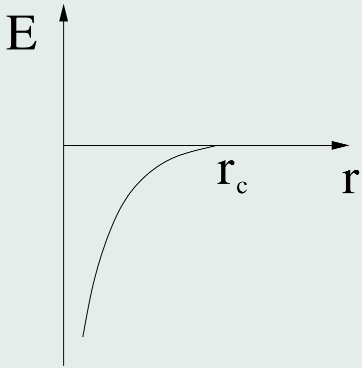
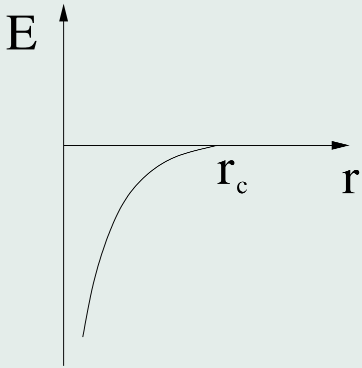



E
$r_c$
r




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

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

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

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## The bond states, case a)

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

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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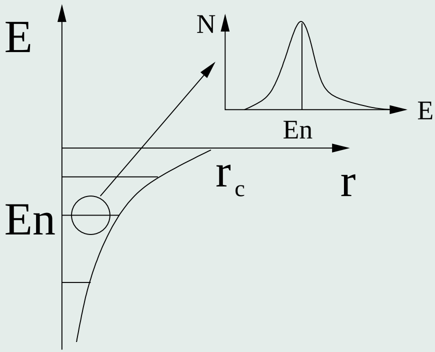
## Free states, case b)

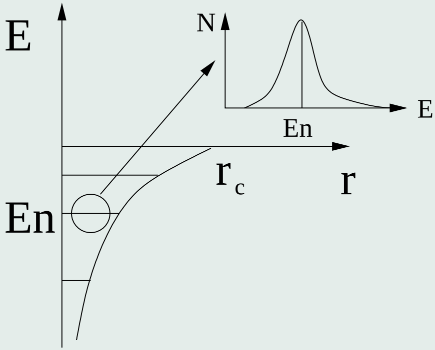
$$P(r) = \begin{cases} C_0 M_{\kappa,\mu}\left(\frac{2r}{a_0\nu^2}\right) & : \quad r < r_c \\ C_0 r\left[C_1\frac{\sqrt{2mE}}{\hbar}j_l\left(\frac{\sqrt{2mE}}{\hbar}r\right) + C_2\frac{\sqrt{2mE}}{\hbar}y_l\left(\frac{\sqrt{2mE}}{\hbar}r\right)\right] & : \quad r \geq r_c \end{cases} \tag{6}$$

# Free states, case c)

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

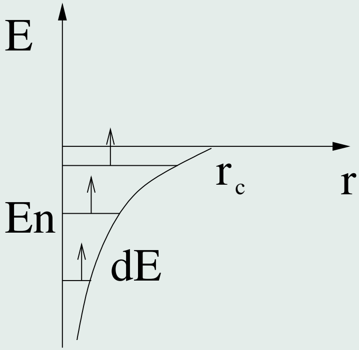
Where $\eta = 1/\sqrt{2(E - 1/r_c)}$


E
N
E
En
rc
r
En




Lorentz:

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


E
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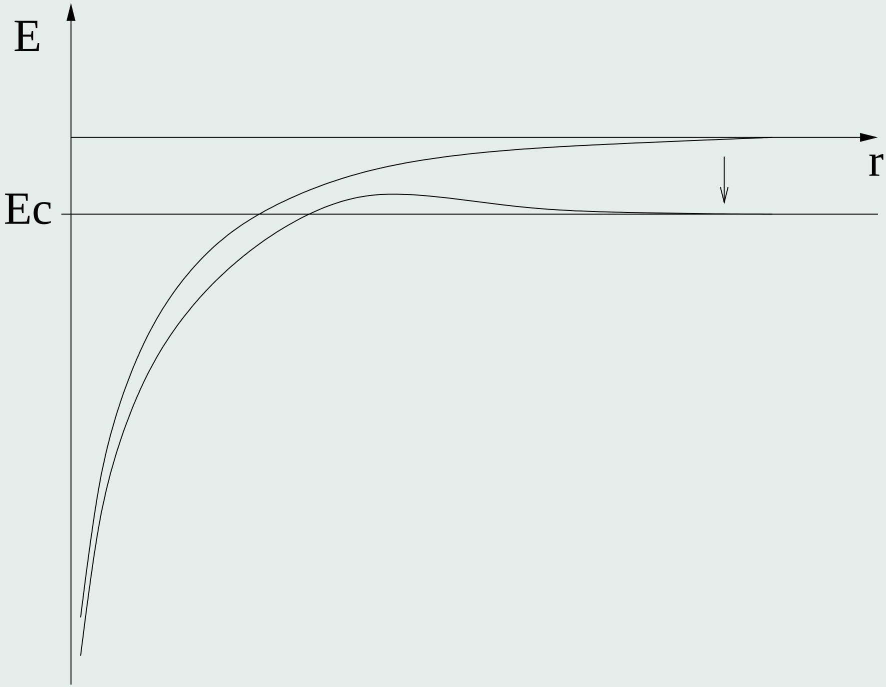
c
r


E
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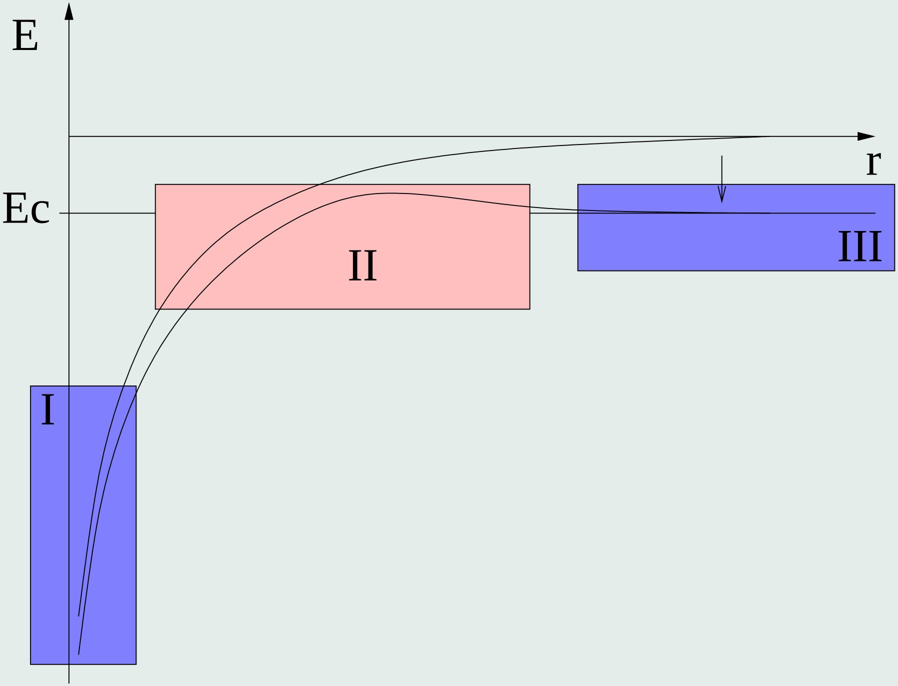
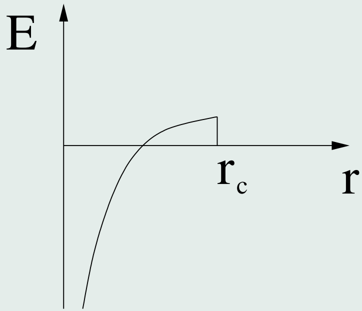
Ec



E
r
Ec
I
II
III


E
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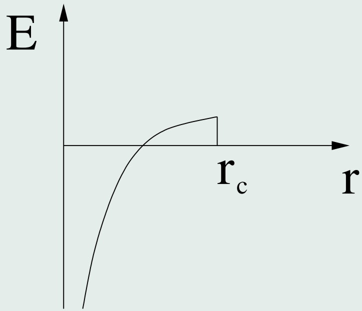
c
r

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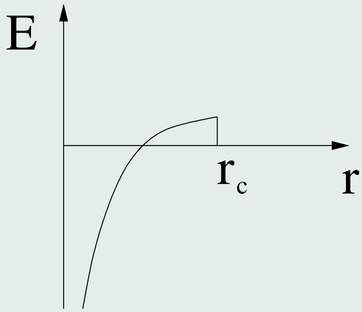


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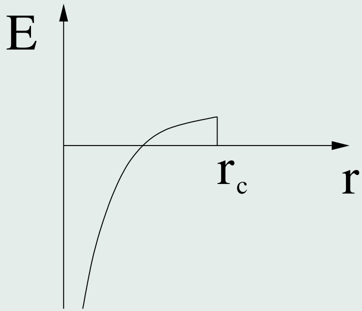


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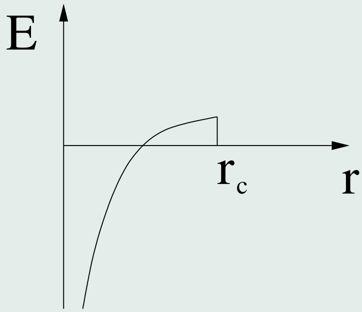


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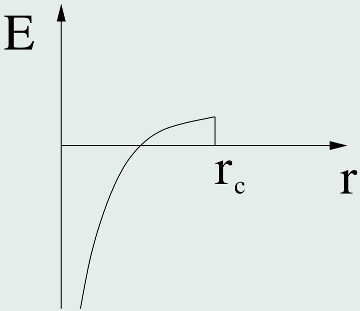


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Where $\eta = 1/\sqrt{2(E - k_{rc} 1/r_c)}$

# 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 |
| 3 | 1 | -1.01716 | -0.275107 |
| 3 | 2 | -1.01683 | -0.275047 |

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- Flexibe, easyly includes additional processes in the QM figure.
- Into the newly introduced QM model potential, the aditional shifting of a levels is a part of the model itself.