W. R. Johnson

An Average-Atom Model

$$\left[h_0 - \frac{Z}{r} + V(r)\right] \phi_a(\boldsymbol{r}) = \epsilon_a \phi_a(\boldsymbol{r})$$

potential:

$$V(r) = \begin{cases} \int \rho(r')/R\, d\tau' - (3\rho(r)/\pi)^{1/3} & r \le R_0 \\ 0 & r > R_0 \end{cases}$$

density:

$$\rho_b(r) = \sum_a \frac{2j_a + 1}{1 + \exp[(\epsilon_a - \mu)/kT]} P_a^2(r)$$

$$\rho_c(r) = \sum_\kappa \int_0^\infty \frac{(2j_\kappa + 1)\, d\epsilon}{1 + \exp[(\epsilon - \mu)/kT]} P_{\epsilon\kappa}^2(r)$$

norm:

$$Z = \int_0^R 4\pi r^2 \rho(r)\, dr$$

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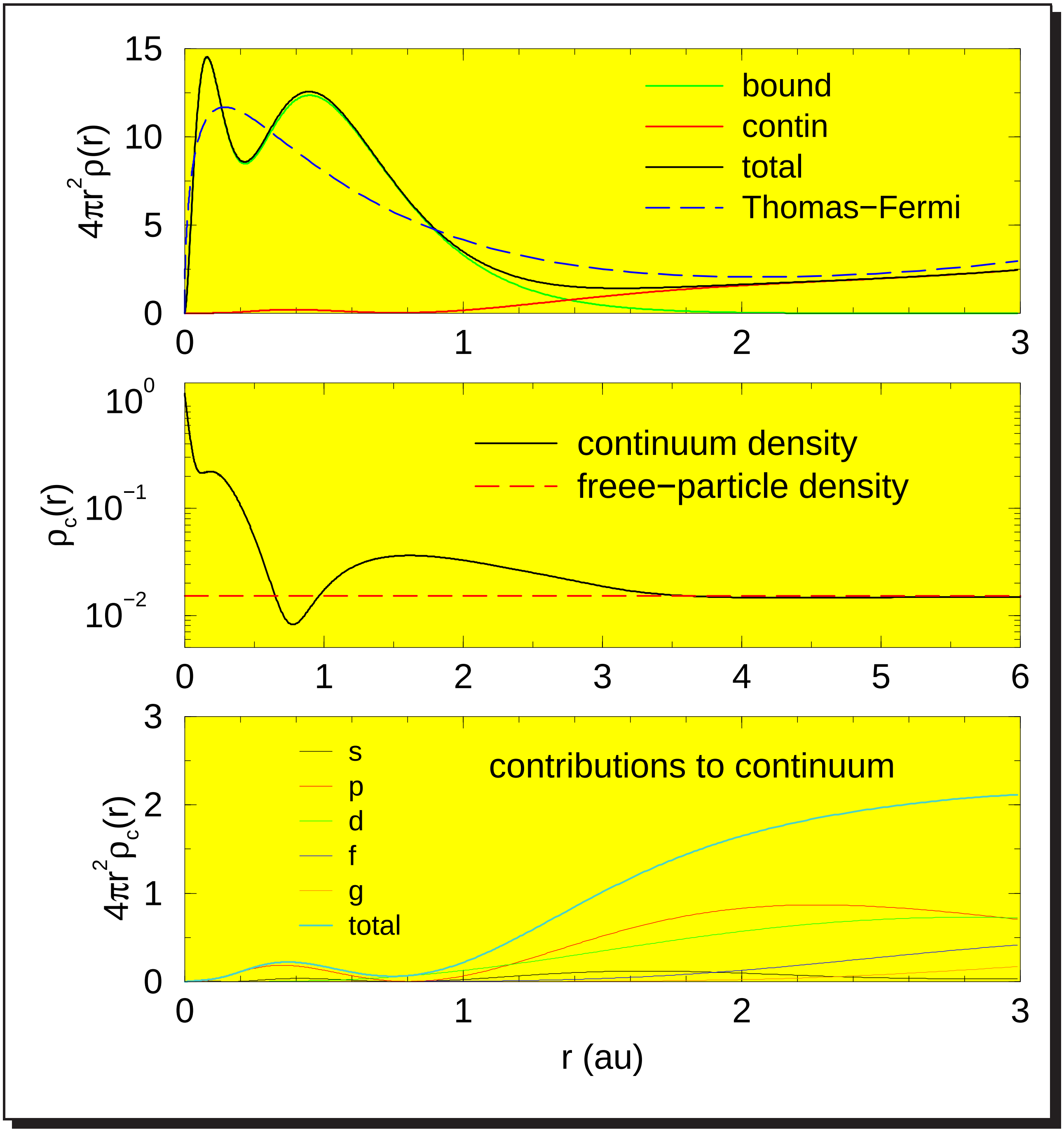
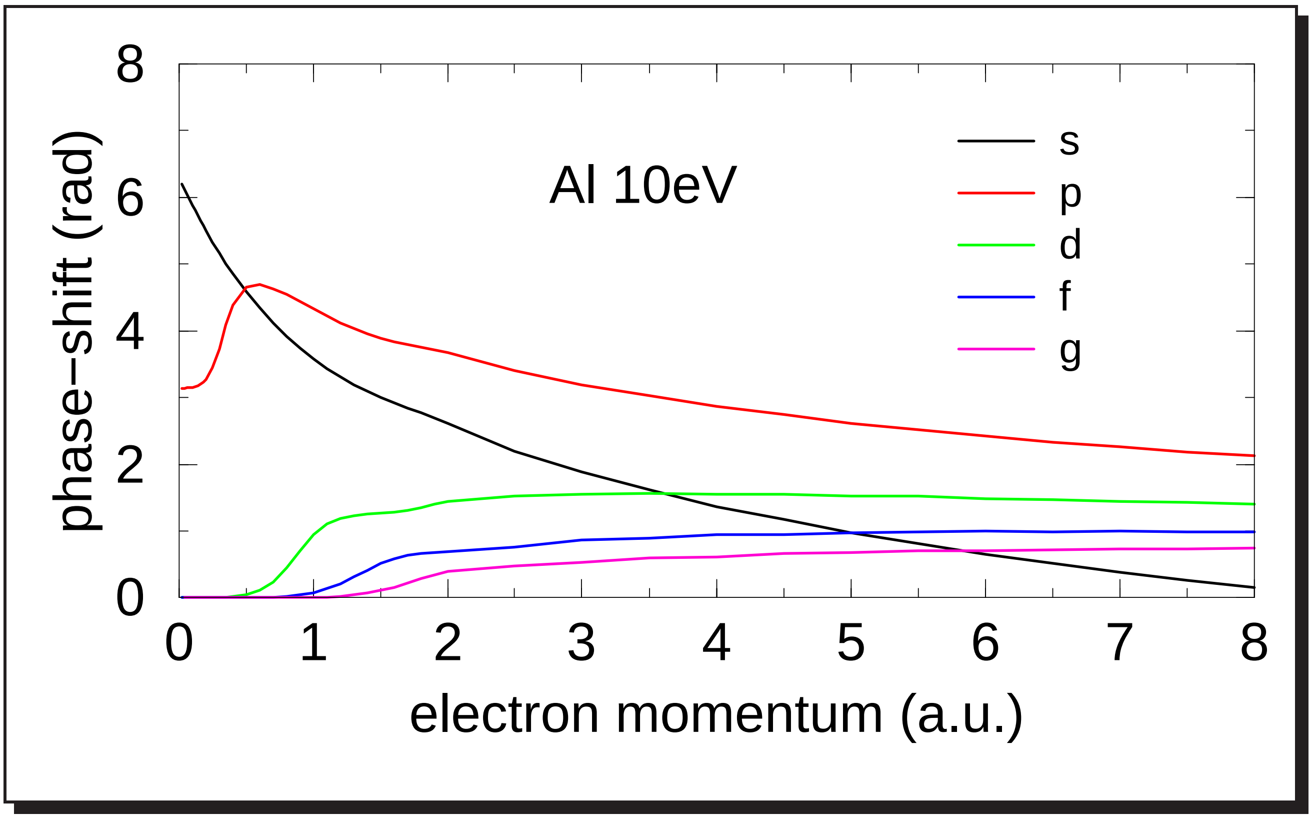
Electron density: Al - T=10eV



Phase shifts: Al - T=10eV



Resistivity:

Drude picture: 1900

$$\rho = \rho_0/(n_e\,\tau)$$

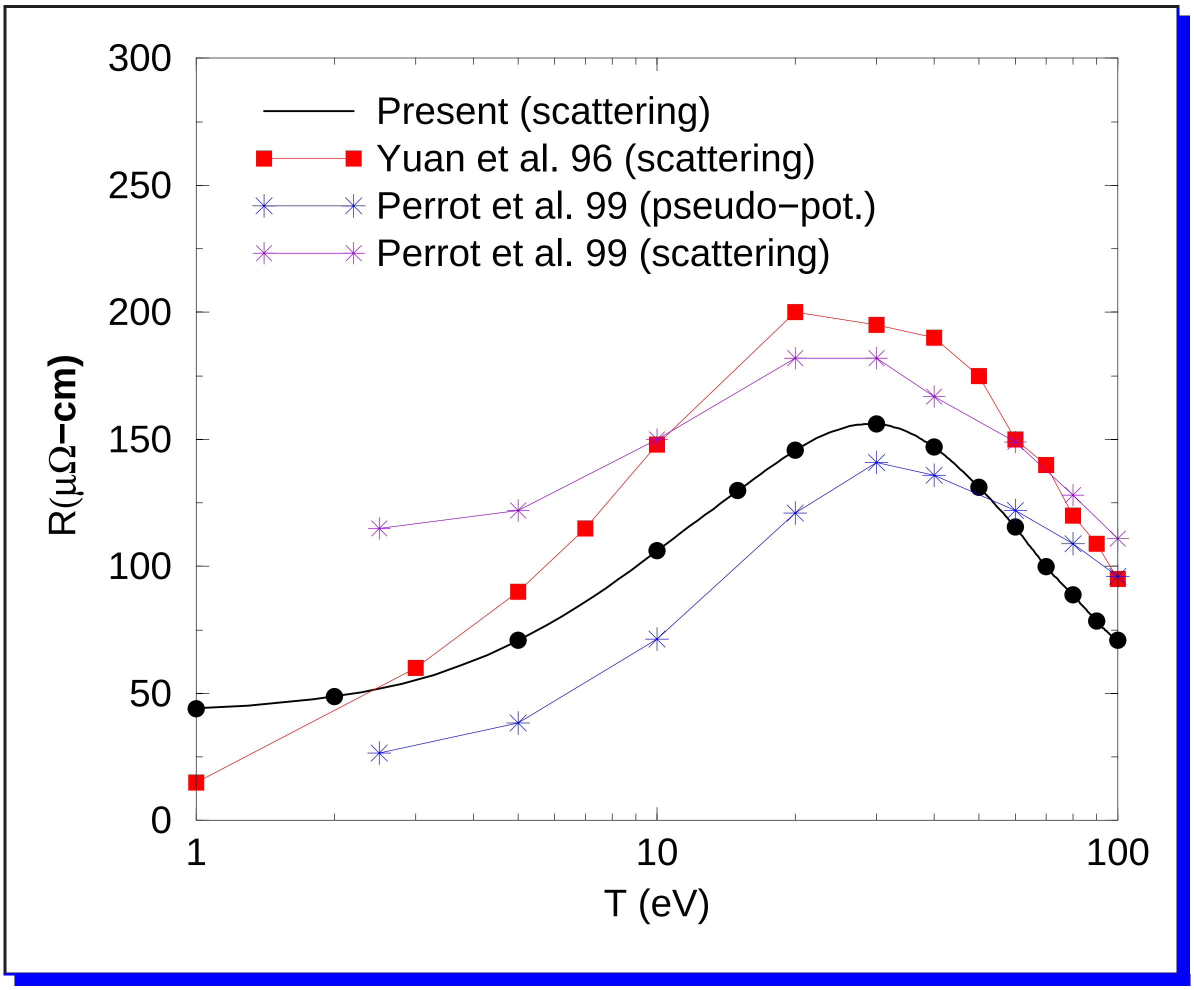
$$\rho_0 = m\,a_0^3/(e^2\,\tau_0) = 21.74\ \mu\,\Omega\text{–cm}$$

Ziman: 1972 - 1988

$$\frac{1}{\tau} = \frac{1}{3\pi Z^*}\left\langle \int_0^{2p} dq\ q^3\,\sigma(q)\,S(q) \right\rangle$$

$$\langle F(\epsilon)\rangle = -\int_0^{\infty} d\epsilon\ \frac{d}{d\epsilon}\left(\frac{1}{1+\exp(\epsilon-\mu)/kT}\right) F(\epsilon)$$

Resistivity: Al - T=10eV



Present calculation of resistivity of aluminum compared with other calculations. [1] [2]

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[1] J. K. Yuan, Y. S. Sun, and S. T. Zheng, Phys. Rev. E **53**, 1059 (1996).

[2] F. Perrot and M. W. C. Dharma-wardana, Int. Jour. of Thermophys. **20**, 1299 (1999).