of $\sigma \approx 18\%$ for interatomic potentials above 2 eV. For potentials below 2 eV there is virtually no convergence in any reduced coordinate system.

The new reduced screening functions were then fit similarly to the individual ones with a series of exponentials to obtain a universal screening function:

$$\Phi_U = .1818e^{-3.2x} + .5099e^{-.9423x} + .2802e^{-.4028x} + .02817e^{-.2016x} \qquad (2-61)$$

This curve is shown in figure (2-17) with the statistical atom screening functions. This universal screening function is an improvement to one found by Wilson et al. (77f) which they identify as a C-Kr potential. This universal screening function has been further reviewed (85a) by comparing 106 experimentally determined potentials with theoretical ones. Their results are shown in the following table:

Potential Type	Screening Length	Theory/Exp. Standard Deviation
Moliere	a_I	237%
Lenz-Jensen	a_I	142%
C-Kr	a_U	7%
Universal	a_U	5%

Energy Transfer from Projectile Atom to Target Atom

We shall first briefly review the formulae we will need which were derived at the beginning of this chapter. The energy transferred during the screened Coulomb collision of two atoms will be described as a function of two variables, the projectile atom's initial energy, E, and its impact parameter, p. These are identified in figure (2-1), with p being defined as the projected offset of the original path of Z_1 from Z_2. If these two variables are known, then the scattering angle in the CM system, Θ, can be determined using Eq. (2-29). From this the energy transfer, T, to the target atom can be determined simply from conservation of energy and momentum, as was shown in the derivation of equation (2-16):

$$T = \frac{4M_1M_2}{(M_1 + M_2)^2} E_o \sin^2\frac{\Theta}{2} = \frac{4E_cM_c}{M_2} \sin^2\frac{\Theta}{2} \qquad (2-62)$$

where M_1 and M_2 are the masses of atoms, Z_1 and Z_2, and where Θ is the projectile's scattering angle in center-of-mass coordinates, which is related to the lab frame by:

$$\vartheta = \tan^{-1}\{\sin\Theta/[\cos\Theta + M_1/M_2]\}. \qquad (2-63)$$

where ϑ is the laboratory final deflection angle of the projectile, see equation (2-17).

As discussed at the beginning of this chapter, the problem of a two body collision may be reduced to that of a particle in a single central-force field if the following conditions are met: (a) The potentials are spherically symmetric and do not vary with time or with either particle's velocity, and (b) The laws of the conservation of energy and momentum are

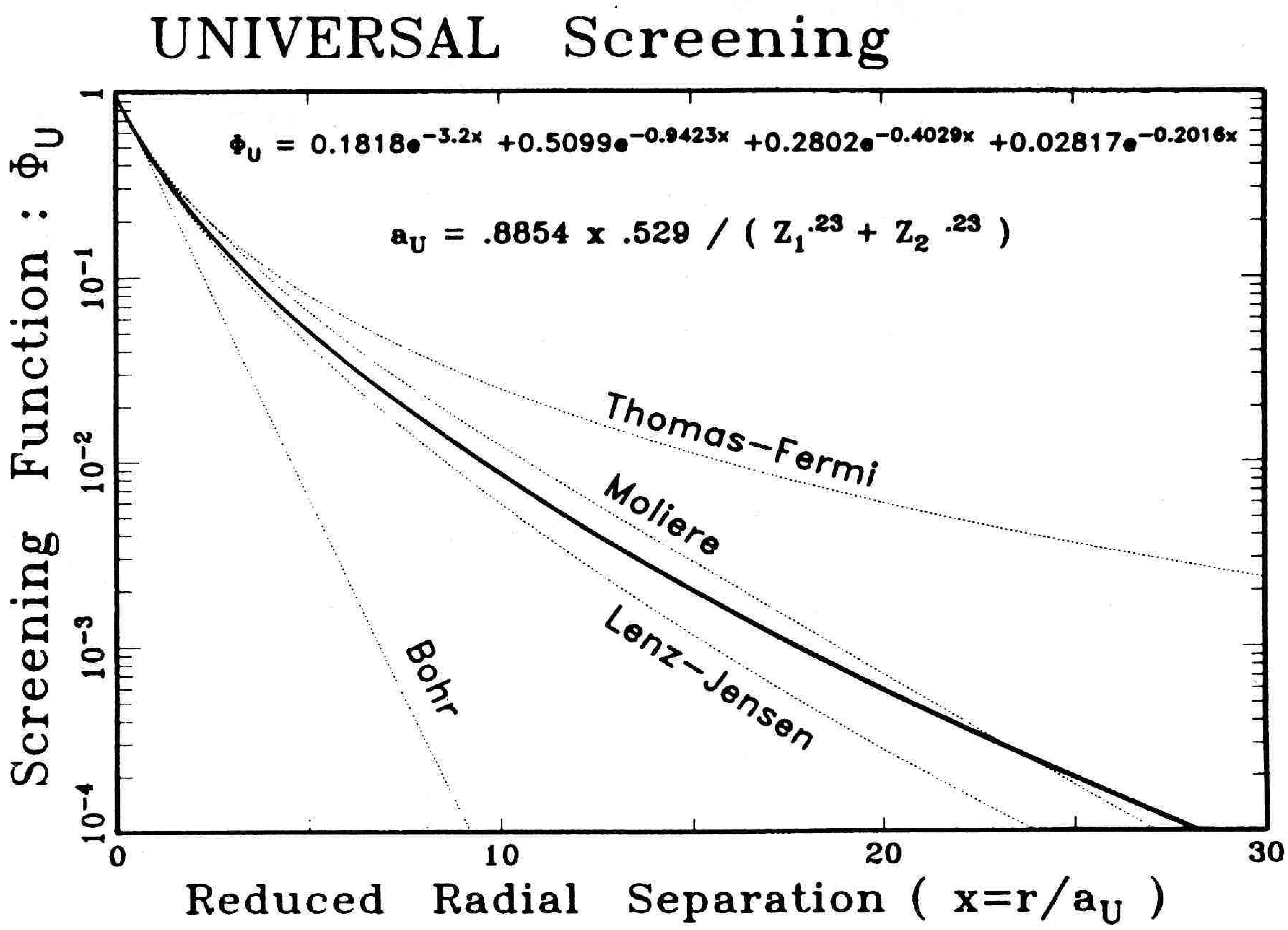

Figure (2-17) The reduced screening functions of figure (2-16) have been fitted to the analytic expression shown above with four exponential terms. This screening function is identified as Φ_u, a universal screening function with its argument, x, being defined as $x \equiv r/a_u$, where a_u is the universal screening length shown above. This screening length is important in converting the screening function, Φ, back to the real potential, V, using eq. (2-56).