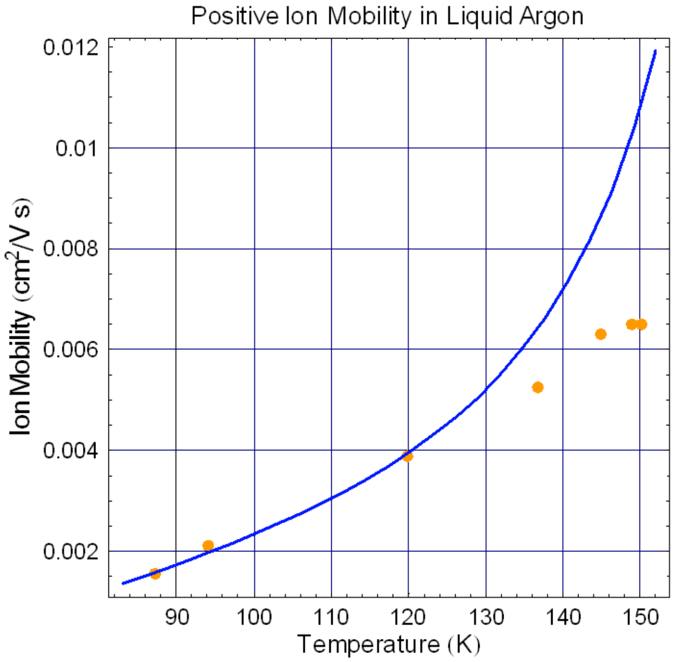
Ion Drift Velocity [26]



Gee, *et al*. [26] provide measurements of the positive ion mobility in liquid argon from the normal boiling point up to the critical point, and demonstrates that the mobility is independent of electric field and that the product of mobility and liquid viscosity are constant (Stoke's law):

$$\mu_+ \eta = (4.3 \pm 0.3) \times 10^{-6}\ Poise\, cm^2 / V s$$
$$\text{for } 87.2\text{K} \le \text{T} \le 135\text{K}$$

The curve in the figure above is the liquid viscosity from [5] scaled to the lowest three data points of [26].

Pade approximant:

$$\eta(T) = \frac{A + B T^{-1} + C T^{-2}}{1 + D T^{-1} + E T^{-2}}$$

$$v_{D,Ion}(E,T) = 4.32 \times 10^{-6}\, E\, \eta(T)$$

$v_{D,Ion}$ = positive ion drift velocity in mm/μs

T = temperature in K

E = electric field in V/cm

$$for\ 83.8 \le T \le 100, \quad A = \text{-}2.46184 \times 10^8, \quad B = 4.51273 \times 10^{10}, \quad C = -4.51527 \times 10^{11},$$
$$D = 2.15074 \times 10^8, \quad E = \text{-}1.28168 \times 10^{10}$$

Ions are in thermal equilibrium with the liquid, so the diffusion coefficient is

$$D_+ = \mu_+ \eta \times k_B T_{NBP} = 3.2 \times 10^{-3} cm^2 / s$$