[tex69] **Mobility of a hard sphere in a dilute gas**

The mobility constant μ in the equation $\mathbf{u} = \mu \mathbf{F}_{app}$ relates the steady state velocity $\mathbf{u}$ of an object moving through a fluid to the external force applied to the object. In steady-state motion, the external force is balanced by the average force $\mathbf{F}$ exerted by the fluid particles on the object: $\mathbf{F}_{app} = -\mathbf{F}$.

Show that the average force exerted by a dilute gas (density n, particle mass m, temperature T) on a slowly moving heavy hard sphere (radius R, velocity $\mathbf{u}$ with $u \ll \langle v \rangle$) is

$$\mathbf{F} = -\frac{8}{3}\sqrt{2\pi m k_B T} R^2 n \mathbf{u}.$$