

$$\tau_{\rm rel} = 1/\langle \Gamma \rangle = 1/\int {\rm d}^3v_1 {\rm d}^3v_2 f(\vec{v}_1) f(\vec{v}_2) n_\chi v_{\rm rel} \sigma(v_{\rm rel}) (v_{\rm rel}/v_0)^2$$