

(3) A hydrogen molecular ion, H_2^+ , accelerated to 1 MeV, passes through a metal foil 100 Å thick. Its only electron is thereby stripped off without significantly slowing the nuclei. By roughly how large an angle will the subsequent trajectories of the two protons diverge?

Assume the molecular axis is perpendicular to the line of flight and the protons are left about 1 Å apart when the electron is stripped off. (That is close to the internuclear distance in the hydrogen molecular ion.) Their mutual repulsion will now cause each proton to acquire about 7 eV in kinetic energy of transverse motion. Its trajectory will have been deflected through the small angle $(0.7/500,000)^{1/2}$ or 1.2 milliradians. For the divergence of the two proton trajectories we may therefore expect something like 1 or 2 milliradians, depending on the orientation of the ion when it penetrated the foil.