Title: Stopping and ionization at few keV

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Abstract:
A charged particle gradually slows down while penetrating matter. In a wide range of beam velocities, from that of the atomic electrons to velocities approaching that of light, a penetrating particle primarily loses energy to the electrons of the target, i.e. the main cause of energy loss originates from excitation and ionization.
To produce new insights into these processes, we have at CERN studied the energy loss and ionization probability for antiprotons in a number of solids and gases. Recent results for the ionization cross section of He indicate a substantiation of expectations based on earlier results. This indicates that the probability of releasing an electron drops to very low values for sufficiently low velocities of the antiproton projectile. If this can be confirmed in future measurements, it is a surprise which shows a lack of understanding of simple collision processes at low energies.
Furthermore, measurements of the stopping power of antiprotons in a range of solid targets, metals as well as insulators, shows an absence of an expected threshold effect in the case of an insulator. This threshold effect is due to the presence of a finite band-gap which transforms into a restriction on the momentum transfers, which in turn leads to a reduced stopping power as compared to the velocity-linear behaviour observed in metals. The absence of such a threshold effect - formerly observed for protons - can not be explained by band-gap reduction due to the formation of molecular orbitals for antiprotons.