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Interaction of Ultraintense Particle Beams with Dense Matter: Coherent Effects of Stopping and Radiation

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The theory of Coherent Stopping Power (CSP) of ultradense charged particle beams propagating in a dense matter is presented.

CSP corresponds to a collective inelastic collision which adds to the ordinary stopping power of individual particles.

Unlike the latter, which depends only on the particles' energy, CSP depends upon many more parameters such as the total charge of the ensemble and its charge density and shape. This paves the way for a broad variety of non-standard methods to tailor particle absorption and penetration in a dense matter.

CSP losses can be explained both by collective excitations of single or multiple molecules and by the emission of coherent Cherenkov radiation.

Given the advent of ultraintense particle sources and their use for relevant applications, CSP could be of great interest for future experiments.

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