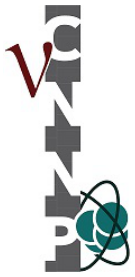

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Heavy ion charge exchange reactions as probes for nuclear β-decay

Thursday, 27 February 2020 11:30 (30 minutes)

The status and prospects of heavy ion charge exchange reactions are discussed. Their important role for nuclear reaction, nuclear structure, and beta-decay investigations is emphasized. Dealing with peripheral reactions, direct reaction theory gives at hand the proper methods for single (SCE) and double charge exchange (DCE) ion–ion scattering. The microscopic descriptions of charge exchange ion–ion residual interactions and the reaction mechanism are obtained by distorted wave theory. Ion–Ion optical potentials and reaction form factors are determined in a folding approach by using NN T-matrices and microscopic ground state and transition densities, respectively. The theory of onestep direct and two-step transfer reaction mechanisms for SCE reactions is discussed and illustrated in applications to data. Specific SCE reactions are discussed in detail, emphasizing the versatility of projectile–target combinations and incident energies. SCE reactions induced by 12C and 7Li beams are presented as representative examples. Heavy ion DCE reactions are shown to proceed in principle either by sequential pair transfer or two kinds of collisional NN processes. Double single charge exchange (DSCE) is given by two consecutive SCE processes, resembling in structure 2ν2β decay. A competing process is a two-nucleon mechanism, relying on short range NN correlations and leading to the correlated exchange of two charged mesons between projectile and target. These Majorana DCE (MDCE) events are of a similar diagrammatic structure as 0ν2β decay. The similarities of the DSCE and MDCE processes to pionic DCE reactions are elucidated. An overview on recent applications to heavy ion DCE data is given.

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