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Fission fragment rotational modes: Classification, agitation, observation

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Nuclear fission produces fragments whose spins are correlated both mutually and with the fission direction. The character and degree of the correlations depend on the time scales of the various rotational modes in the evolving dinuclear complex prior to scission. The expected rotational dynamics is discussed based on the nucleon-exchange mechanism.

Photon angular correlations can reveal information about the orientations of the fission fragment angular momenta. Identified stretched E2 collective transitions in even-even fission product nuclei are particularly suitable because they do not change the orientation of the nuclear spin and the associated angular distribution relative to the direction of a fission fragment reflects the orientation of the fragment spins relative to the fission axis. Furthermore, if the photon helicities can be determined, the distribution of the opening angle between E2 photons from even-even partner fragments reveals the mutual correlation of the fragment spins, demonstrating the potential power of helicity measurements in fission.

Author: RANDRUP, Jorgen

Presenter: RANDRUP, Jorgen

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