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Angular Momentum in FREYA: A Status update

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R. Vogt1,2
1 Nuclear and Chemical Sciences Division, Lawrence Livermore National Laboratory, Livermore, CA 94551, USA
2 Physics and Astronomy Department, University of California at Davis, Davis, CA 95616, USA

The fission simulation model FREYA is well suited for studying the role of angular momentum in fission because it obeys all conservation laws, including linear and angular momentum conservation at each step of the process. This status update explains how the angular momentum treatment in FREYA is based on the nucleon-exchange mechanism which agitates collective rotational modes in which the two fragment spins are highly correlated (but nevertheless the resulting fragment spins are largely uncorrelated). Furthermore, we briefly describe recent refinements in the treatment of the photon radiation cascades from the excited product nuclei. Several angular-momentum related observables are discussed, including various correlated observables [1]. For example, there is a marked correlation between the spin magnitude of the fission fragments and the photon multiplicity. We also consider the dynamical anisotropy caused by the rotation of an evaporating fragment and study especially the distribution of the projected neutron-neutron opening angles, showing that while it is dominated by the effect of the evaporation recoils, it is possible to extract the signal of the dynamical anisotropy by means of a Fourier decomposition. Finally, it is shown that a sawtooth-like behavior in the mass dependence of the average fragment spin naturally emerges when shell and deformation effects are included in the moments of inertia of the fragments at scission [2].

[1] R. Vogt and J. Randrup, Phys. Rev. C 103, 014610 (2021).
[2] J. Randrup and R. Vogt, Phys. Rev. Lett. 127, 062502 (2021).

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Auteur principal: VOGT, Ramona (Lawrence Livermoore National Laboratory)

Orateur: VOGT, Ramona (Lawrence Livermoore National Laboratory)

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