Experimental Signatures of Quasifission*

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Three decades ago, it was first recognized that the observation of fission fragments in heavy-ion induced reactions does not necessarily mean that they originate from the fission decay of a compound nucleus formed by the fusion of the projectile and the target nuclei. This conclusion was based on several different observations. First, it was recognized that the fission cross section exceeded the upper bound imposed by the existence of a stabilizing pocket in the ion-ion potential – thus some of the fission cross section must originate from partial waves that do not proceed through a compound nucleus [1,2] and, in addition, that the fission mass distribution in these cases was observed to be wider than expected on the basis of a compound nucleus model. Concurrently, it was noted [3] that the fission fragment anisotropy in heavy-ion induced fission substantially exceed expectations based on the transition state model. Subsequent studies of the two-dimensional mass-angle distribution of fission fragments [4-6] clearly demonstrated that these fragments are the result of a dynamic process, in which the system evolves toward mass symmetry on a time scale that is commensurate with the rotational period of the complex. This process is now referred to as "quasi-fission" [7] although the terms "fission without a barrier' [1] and "fast fission" [2] were also used.

Recently, much progress in the theoretical description of this process has been achieved [8,9] and further precise experiments have been conducted [10-12], which provide further constraints on our understanding of these complex processes that also play a critical role in attempts to synthesize heavy and super-heavy nuclei via heavy-ion fusion processes. In this talk I'll discuss some of the history and recent developments in the study of the quasi-fission process.

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