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Title: Event-by-Event Neutron and Photon Multiplicity Correlations in Nuclear Fission

Abstract:

The nuclear fission process is a complicated many-body process that gives rise to a wide distribution of fission products that promptly decay by emitting neutrons and gamma rays. The emission of these particles is highly correlated to the conditions of the fragment along the de-excitation path. At DNNC, we measure the neutron-gamma emission accompanying spontaneous and induced fission to validate and improve models of fission. Two of the most important open areas of research in fission modeling are the mechanism behind the sharing of excitation energy and the generation of angular momentum. In order to investigate these mechanisms, we have measured the emission of neutrons and gamma rays for the spontaneous fission of ^{252}Cf , determining the multiplicity correlations between the two particles. As one might expect from energy conservation, neutrons and gamma-rays are, on average, negatively correlated to one another; however, after developing more advanced correlation analysis techniques, we have determined that structure appears in the energy-dependent neutron-gamma correlations. Specifically, we have recently observed positive correlations between neutrons and gamma ray with energies consistent with rotational band transitions. This observation indicates the existence of an energy-dependent component in the angular momentum generation at fission.