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Nuclear Bremsstrahlung and Radiation Effects: Implications for Nuclear Engineering and Astrophysics NIE LUO, University of Illinois, MAGDI RAGHEB, GEORGE MILEY, BARCLAY JONES — We consider the effect of nuclear bremsstrahlung in proton-neutron and proton-deuteron reactions. The average center-of-mass energy for such reactions is around keV in a number of nuclear engineering problems. At this low energy, the reacting nucleons are in an s-wave state in terms of their relative angular momentum. The single-gamma radiation process is thus strongly suppressed due to conservation laws. Instead the gamma ray released is likely to be accompanied by soft X-ray photons from a nuclear bremsstrahlung process. The release of soft phonons invalidates the impulse approximation assumed in the calculation of a number of nuclear processes. Its effects on a few nuclear cross-sections at the epithermal energy are discussed. The generated soft X-ray has a continuous spectrum and peaks around a few hundred eV to a few keV. The average photon energy and spectrum properties of such a process are calculated with a semiclassical approach. The experimental observation of this phenomenon is complicated by the presence of electron bremsstrahlung in a fusion tokamak. However, its unique spectrum also opens up the possibility of new plasma diagnostics more sensitive to the ionic or nuclear degree of freedom. This rediation is also linked to some of the X-ray observations in nuclear astrophysics.

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