PRODUCTION OF NEUTRON-UNBOUND STATES IN INTERMEDIATE-MASS FRAGMENTS FROM ^{14}N + Ag REACTIONS AT E/A = 35 MeV

By

Lawrence Harvey Heilbronn

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ABSTRACT

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The populations of neutron-unbound states and of bound states in intermediate-mass fragments have been measured at 15°, 31°, and 64° from the ^{14}N + Ag reaction at E/A = 35 MeV. The data are identified in terms of the reaction mechanism producing them, which is either a deep-inelastic mechanism or a quasielastic mechanism. In order to test the assumption that the deep-inelastic data are produced from a thermal source, the unbound-state/bound-state population ratios of deep-inelastic fragments are compared to the predictions of a thermal sequential decay model. Most, but not all, of the deep-inelastic population ratios are fitted with model calculations that assume a source temperature between 2.5 and 3.5 MeV. Three or more populations from the same isotope were measured for ^{13}C, ^{12}B, and ^{10}Be. The deep-inelastic populations from ^{13}C and ^{10}Be were fitted with a single temperature, while the deep-inelastic populations from ^{12}B were not fitted. There is enough of the deep-inelastic data that is not fitted with the predictions of a thermal model that the assumption of a thermal source for the production of deep-inelastic fragments may be incorrect, or there may be other effects present which alter the thermal properties of the data. The dependence of the unbound-state/bound-state population ratio on the fragment kinetic energy shows a difference between the quasielastic and deep-inelastic data. For quasielastic fragments whose mass is near the mass of the beam, the ratio decreases towards zero as the fragment velocity approaches the beam velocity. In contrast, the ratio for half-beam

mass quasielastic fragments is constant or only slightly decreasing as the kinetic energy increases. The ratio for deep-inelastic fragments is approximately constant as a function of kinetic energy, independent of fragment mass. The amount of feeding from several neutron-unbound channels into bound states is measured and compared to the sequential decay model. The effect of feeding on both spectral temperatures and on population temperatures is investigated. The effect of feeding on both temperatures, as determined by model calculations, cannot account for the discrepancy in the values between the two.

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