Strong one-neutron emission from two-neutron unbound states in beta decays of r-process nuclei, 86, 87Ga

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Beta-delayed one- and two-neutron branching ratios (P1n and P2n) are measured in the decay of 86Ga and 87Ga at the RI-beam Factory at RIKEN Nishina Center using a high-efficiency array of 3He neutron counters (BRIKEN). Two-neutron emission is observed in the decay of 87Ga for the first time. The large P1n value of 87,86Ga compared to P2n is interpreted as a signature of dominating one neutron emission from the two-neutron unbound states in 86,87Ga. Combined shell model and Hauser-Feshbach statistical model calculations are performed in order to interpret the experimental results. The shell model predicts P2n $>$ P1n for 87Ga decay and the observed P1n $>$ P2n is explained successfully only by including the statistical model. This result is the first experimental demonstration that statistical model has to be invoked to predict the decay properties of multi-neutron emitters and that it must be included in the r-process modeling.