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An investigation of the pygmy dipole resonance in 92-Sr exploiting the beta decay of 92-Rb

Situated at the low-energy tail of the Giant Dipole Resonance (GDR), which is described as an out-of-phase oscillation between protons (Z) and neutrons (N), neutron-rich nuclei exhibit a small resonance like structure of additional electric dipole strength which has been denoted as the Pygmy Dipole Resonance (PDR). The PDR is interpreted, in a geometric picture, as an out-of-phase oscillation between the neutron-skin, formed by the excess neutrons, and an isospin saturated (N≈Z) core. From this, theoretical approaches have been used to connect the neutron-skin to the symmetry term of the nuclear binding energy and the nuclear equation of state. This interpretation however, is a matter of debate. It remains unclear how nuclear shell effects contribute to the electric dipole response while other mechanisms have been proposed. What is more certain, is the impact of additional E1 strength in the region of the neutron separation energy on neutron capture rates in astrophysical calculations.

For decades, Nuclear Resonance Fluorescence (NRF) has been the workhorse for experimental studies of the PDR. However, this method preferentially probes states with strong 1-particle 1-hole components in their wavefunction while information on states with a more complex structure remains missing. Recent studies highlight that for some nuclei, beta decay can be exploited as a complementary experimental probe of the PDR. Beta decay affords greater access to more complex states and overcome some experimental limitations of NRF.

A recent study of PDR states in 92Sr populated via beta decay of 92Rb was performed at TRIUMF with the Gamma-Ray Infrastructure For Fundamental Investigations of Nuclei spectrometer (GRIFFIN). This decay is one of the three main contributors to the antineutrino spectrum and the reactor antineutrino anomaly. The results of this study significantly extend the level scheme of 92Sr and reveal that many states in the region of the PDR exhibit rich decay fragmentation.

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