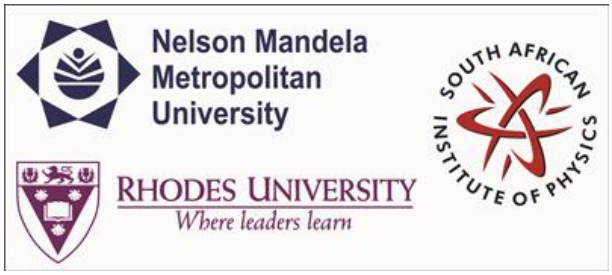

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The Design and Construction of an Active Target Detector for the Study of the 20Ne(α,α')20Ne* Reaction

Friday, 3 July 2015 12:50 (20 minutes)

Abstract content
   (Max 300 words)
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The excited 3α resonant state in 12C, which is crucial for thermonuclear fusion of carbon in red giant stars, was predicted by Fred Hoyle in 1954. Since the experimental observation of the Hoyle state studies have evolved to examine alpha decay processes in other light nuclides such as 8Be and 16O. Cluster studies of 20Ne done with the 22Ne(p,t) reaction revealed a candidate for a 5α state at 22.5 MeV, near the 5α decay threshold. Characterising this state is non-trivial. The cross section of the decay path to the 5α channel is expected to be very low. An active target detector (AcTar) was developed to study the break-up of the 5α state populated by the 20Ne(α,α') reaction. It is designed to be a high-efficiency detector in order to measure reactions with low-energy reaction products and low cross sections.

Over the past two years, AcTar has been designed, built and successfully tested with a 226Ra source. A proposed in-beam test has been accepted by the iThemba LABS programme advisory committee to test the limits of the detector regarding background, count rates and detection of low-energy α-particles. The detector's printed circuit board has 5 sectors, each with 16 signal wires alternating with 17 guard wires. A high-voltage plate opposite the PCB creates an electric field, establishing an active detection region to detect drift electrons that result from decay α-particles moving through the active region. Full kinematic track reconstruction is possible to determine particle energies and positions in order to establish the interaction point within the gas cell. AcTar also has the potential to study clustering in other gas targets such as 16O, 18O, 21Ne, 22Ne and 36Ar, with low-energy detection capabilities for particles decaying from astrophysically important resonances.

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