Refuting the nature of the 0^+_6 Hoyle-analogue state candidate in ^{16}O

Kevin C.W. Li[1], R. Neveling[2], P. Adsley[1,2], P. Papka[1,2], F.D. Smit[2], J.W. Brummer[1], M. Freer[3], Tz. Kokalova[3], F. Nemulodi[2], L. Pellegri[2,4], B. Rebeiro[5], J.A. Swartz[6], S. Triambak[5] and C. Wheldon[3]

[1] Department of Physics, University of Stellenbosch, South Africa
[2] iThemba LABS, National Research Foundation, PO Box 722, Somerset West 7129, South Africa
[3] School of Physics and Astronomy, University of Birmingham,Edgbaston Birmingham, B15 2TT, United Kingdom
[4] University of the Witwatersrand, Johannesburg Wits 2050, South Africa
[5] Department of Physics, University of the Western Cape, Bellville ZA-7535, South Africa
[6] Instituut voor Kern- en Stralingsfysica, KU Leuven, B-3001 Leuven, Belgium

A prominent candidate for a Hoyle-analogue state in ^{16}O is the 0^+_6 state previously observed at E_x = 15.097(5) MeV. This state is identified by several theoretical cluster calculations to be a good candidate for the 4-α cluster state. Whilst much theoretical work has been performed to reconcile a calculated α-cluster state with this resonance, the associated support in experimental work is lagging behind. The primary goal of this work was therefore to provide a more definitive characterisation of the nature of this state and extract the branching ratios of decay channels. To investigate this state, the ^{16}O(α, α') reaction was studied at 0° at an incident energy of E_{lab} = 200 MeV using the K600 magnetic spectrometer at iThemba LABS, whilst proton and α-decays from natural parity states were observed in a large-acceptance silicon-strip detector array at backward angles. The coincident charged particle measurements were used to characterise the decay path of the 0^+_6 state. The data was analysed within a phenomenological R-matrix framework. Results indicate the presence of a resonance at ≈15.1 MeV which does not exhibit a 0^+ nature. Further results shall be presented.