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Search for the 5 alpha cluster state in ^{20}Ne

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Abstract content
 (Max 300 words)

The primary aim of this experimental investigation was to search for the elusive $0^+ 5$ alpha cluster state in ^{20}Ne , which is expected in the energy region above the 5 alpha threshold in ^{20}Ne ($E_x = 19.17$ MeV) [1]. It would be an analogue to the Hoyle state in ^{12}C [2,3], which plays a crucial role in stellar nucleosynthesis and has a well established 3 alpha cluster structure [4].

The secondary aim was to search for new low spin states at high excitation energy in ^{20}Ne .

During four weekends between April and July of 2012, the $^{22}\text{Ne}(p,t)^{20}\text{Ne}$ reaction was investigated with the iThemba LABS K600 magnetic spectrometer. A proton beam with an energy of $E_{\text{lab}} = 60$ MeV from the Separated Sector Cyclotron (SSC) facility impinged on a ^{22}Ne gas target at lab angles of $\theta_{\text{lab}} = (0^\circ, 7^\circ, 16^\circ, 27^\circ)$.

At least three new states in ^{20}Ne have been observed. Two of these appear to be isobaric analogues of known states in ^{20}O . There is also a tentative candidate for the 5 alpha cluster state at around $E_x = 22.49$ MeV in ^{20}Ne .

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[2] F. Hoyle, The Astrophysical Journal, Supplement Series, Vol. 1 p. 12 (1954).

[3] C.W. Cook, W.A. Fowler, C.C. Lauritsen and T. Lauritsen, Phys. Rev. 107, 508 (1957).

[4] A. Tohsaki, H. Horiuchi, P. Schuck and G. Röpke, Phys. Rev. Lett. 87, 192501 (2001).

Apply to be
 considered for a student
 award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
 PhD)?

PhD

Main supervisor (name and email)
and his / her institution

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Would you like to
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No

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