Study of the $^{13}\text{C}(4\text{He},8\text{Be}\ 8\text{Be})n$ breakup reaction

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In 1967 Chevallier et al. [Phys. Rev. 160 (1967) 827] first presented evidence that a 4-alpha linear chain state exists in $^{16}\text{O}$. A measurement of the $^{12}\text{C}(4\text{He},8\text{Be})8\text{Be}$ excitation function revealed a number of resonances in the 16 to 20 MeV excitation energy region, the energy-spin systematics being consistent with that calculated for a linear arrangement of 4 alpha-particles in a chain state configuration. However, a recent repeat measurement of the excitation function [Phys. Rev. C 88 (2013) 064309] has cast doubt on some of the spin assignments made in the Chevallier work, and as such does not support the proposal that a 4-alpha chain state exists in $^{16}\text{O}$.

In an attempt to further clarify this excitation energy region a measurement of the $^{13}\text{C}(4\text{He},8\text{Be}\ 8\text{Be})n$ breakup reaction has been performed at the University of Notre Dame FN tandem facility [Phys. Rev. C 94 (2016) 034313]. The alpha-particles from the decay of excited states in $^{16}\text{O}$ were detected in an array of four (5 x 5) cm double sided silicon strip detectors. The $^{16}\text{O}$ excitation energy spectrum obtained indicates that $8\text{Be} + 8\text{Be}$ breakup is observed from a possible 2+ state at 17.3 MeV, a 4+ state at 18.0 MeV, a 2+ or 4+ state at 19.4 MeV and a 4+ or 6+ state at 21.0 MeV. The results will be discussed in relation to both the $^{12}\text{C}(4\text{He},8\text{Be})8\text{Be}$ excitation function and $^{12}\text{C}(16\text{O},4\text{alpha})^{12}\text{C}$ breakup reaction [Phys. Rev. C 51 (1995) 1682].