Possible High-Lying Octupole States in ^{196}Pt via the (d,d') Reaction ◇

P. D. Cottle[a], N. V. Zamfir[b,c,d,e], R. F. Casten[b,c], Gh. Cata-Danil[e], S. Deylitz, A. Gollwitzer, R. Hertenberger, B. D. Valnion, and G. Graw

[a] Florida State University, Tallahassee, FL 32306, USA
[b] Brookhaven National Laboratory, Upton, NY 11973, USA
[c] WNSL, Yale University, New Haven, CT 06511, USA
[d] Clark University, Worcester, MA, 01610, USA
[e] Institute of Atomic Physics, Bucharest Magurele, Romania

The behavior of octupole states in the stable Pt isotopes is anomalous in several respects. While the energies of 3^-_1 states in other mass regions vary smoothly, there is a gap of approximately 1 MeV between the energies of the 3^-_1 states in the even mass Pt isotopes and the collective octupole states in ^{198,200,202,204}Hg [1]. However, Cottle, Stuckey and Kemper [2] proposed that strong fragmentation of the low energy octupole state in Pt might explain the anomaly. They reanalyzed the angular distributions measured in the 35 MeV ^{194,196,198}Pt(p,p') reactions by Deason *et al*. [3], and proposed that several states between 2 and 3 MeV which were strongly populated in those reactions have $J^\pi = 3^-$. If the systematic behavior of the octupole strength centroid is examined (instead of just the 3^-_1 states), a smooth trend is observed and the anomalous behavior of the octupole states is explained. In addition, it was found [4] that strong octupole fragmentation, such as that proposed for ^{194,196,198}Pt, is characteristic of nuclei conforming to the O(6) dynamical symmetry of the Interacting Boson Approximation (IBA), of which ^{196}Pt is the best-known example [5].

However, the (p,p') angular distributions of the possible 3^- states analyzed in [2] were not sufficient to definitively distinguish between 3^- and 4^+ spin assignments. To address this issue, we measured angular distributions from the ^{196}Pt(d,d') reaction at 22 MeV using the QDDD magnetic spectrograph and the high resolution focal plane detector. The shapes of the angular distributions in the (d,d') reaction are better suited to distinguish between 3^- and 4^+ states than those from the (p,p') reaction. Spectra were collected for a wide range of excitation energies (from 0 to 3.5 MeV) and angles (15 degrees to 45 degrees in 5 degree steps), the energy resolution was approximately 6 keV FWHM. Analysis of the angular distributions is underway.

References

[1] R. H. Spear, At.Data Nucl.Data Tables **42** (1988) 55
[2] P. D. Cottle, K. A. Stuckey, and K. W. Kemper, Phys.Rev. **C38** (1988) 2843
[3] P. T. Deason, C. H. King, R. M. Ronningen, T.-L. Khoo, F. M. Bernthal, and J. A. Nolen, Phys.Rev. **C23** (1981) 1414
[4] N. V. Zamfir, P. D. Cottle, J. L. Johnson, and R. F. Casten, Phys.Rev. **C48** (1993) 1745
[5] J. A. Cizewski, R. F. Casten, G. J. Smith, M. L. Stelts, W. R. Kane, H. G. Börner, and W. F. Davidson, Phys.Rev.Lett. **40** (1978) 167

◇ Work supported by the DFG under IIC4-Gr 894/2.