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The single-particle structure around ^{132}Sn explored through the (d,p) reaction[1]

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The nuclear shell model[1], originally developed by Maria Geoppert Mayer in 1949 (Nobel Prize 1963) has been used extensively to explain the structure of nuclei. The atomic shell model describes the increased stability observed when an electron shell is filled. Correspondingly, nuclei with magic numbers of protons or neutrons (2, 8, 20, 28, 50, 82, 126) display additional stability. Only ten nuclei to date have been observed which have these standard magic numbers for both neutrons and protons, of these, half are stable or very long-lived. Many changes have been observed in nuclei as we move away from the valley of stability and it is important, both to nuclear structure physics and to understanding the synthesis of nuclei in the cosmos, to understand how these changes affect single-particle states.\One exotic doubly-magic nucleus which can be produced with sufficient intensity to perform reactions on it is ^{132}Sn. Recent calculations[2] have shown that the structure around ^{132}Sn may affect the freeze out of the rapid neutron capture (r-)process, believed to occur in supernovae, which is responsible for the production of about half the nuclear species heavier than iron. By adding a neutron to a beam of ^{132}Sn via a transfer reaction, it is possible to study single-particle states beyond the double-shell closure. I will present results from a recent measurement of ^{133}Sn via the ^{132}Sn(d,p) reaction in inverse kinematics.

[1] Maria Goeppert Mayer, *Science* **145** 999 (1964).
[2] R. Surman and J. Engel, *Phys. Rev. C* **64**, 035801 (2001).

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