

SES11-2011-000044

Abstract for an Invited Paper
for the SES11 Meeting of
the American Physical Society

Selected Highlights in Nuclear Research in the Southeast by Vanderbilt and ORNL

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On the one hundredth anniversary of the discovery of the nucleus, selected highlights in nuclear research by Vanderbilt scientists and by Oak Ridge National Laboratory scientists as well as their joint research are described. These will include the earliest work involving the first confirmation of neutron induced fission and classic papers on the fission process. This was followed by the development of the barrier for the gaseous diffusion separation of ^{235}U from ^{238}U . In the 1940's the first working nuclear reactor became operational at ORNL, to make ^{239}Pu followed by the first radioisotopes for nuclear medicine, neutron scattering to probe materials leading to a Nobel Prize and the first observation of the β decay of the free neutron. In 1953 Hill and Wheeler published their classic nuclear theory paper that has over 2000 citations. In the 1960's large E0 transitions were observed in decays of β but not γ vibrational bands to confirm the predictions of Bohr and Mottelson that β vibrations change the nuclear deformation. Then the first failures of the B-M model were observed. In the 1970's the paradigm that each nucleus had one fixed shape was changed when the discovery of the coexistence of overlapping bands built on different deformations were observed. This was made possible, in part, by universities building the first isotope separator on-line to the Oak Ridge cyclotron. This was followed by the discovery of the reinforcement of proton and neutron shell gaps at the same deformation to give superdeformed double magic nuclei. Other highlights will be presented, including the recent discovery of the new element 117 and confirmation of new elements 113 and 115.