SEMIEMPIRICAL SHELL MODEL MASSES WITH MAGIC PROTON NUMBER Z = 126 FOR SUPERHEAVY ELEMENTS

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Recently (1) $^{293}118$ was produced and α-decayed sequentially down to ^{269}Sg (Z = 106). The α-decay energies vary rather smoothly along the chain, precluding Z = 114 as a magic proton number in these nuclei. Recent phenomenological studies of BE(2) (2) and Wigner term (3) systematics, and also self-consistent mean-field calculations (4), indicate Z = 126 as the next proton magic number beyond lead. (See also (5).)

The semiempirical shell-model mass equation (SSME) (6) is based on the assumption that Z = 114 is the next proton magic number after lead, and it stops there. Moreover, the quality of its agreement with the data starts deteriorating beyond Hs (Z = 108). One has to find a substitute for the equation in the neighbourhood of Z = 114 and beyond.

In the early stages of developing the SSME (7) both Z = 114 and Z = 126 were tried as a shell boundary. The agreement with the data was about the same for both choices, and considering the prevailing view in the mid nineteen-seventies Z = 114 was chosen for the SSME mass table. Here we establish a high predictive power for the Z = 126 results by comparing them to the newer data measured since then, and propose using the Z = 126 mass equation as a substitute for the SSME in superheavy elements (SHE) research.

The equation is applied to discussing the results of two recent SHE experiments (1,8). It is in good agreement with the measured energies in (1).

References:
(1) V. Ninov et al., Phys. Rev. Lett. **83**, 1104 (1999).
(2) N.V. Zamfir et al., Phys. Lett. **B357**, 515 (1995).
(3) N. Zeldes, Phys. Lett. **B429**, 20 (1998).
(4) S. Ćwiok et al., Nucl. Phys. **A 611**, 211 (1996).
(5) M. Bender et al., Phys. Rev. **C60**, 034304 (1999).
(6) S. Liran and N. Zeldes, At. Data Nucl. Data Tables **17**, 431 (1976).
(7) S. Liran, Calculation of Nuclear Masses in the Shell Model, Ph.D. Thesis, Jerusalem, 1973. (In Hebrew. Unpublished.)
(8) Yu.Ts. Oganessian et al., Phys. Rev. Lett. **83**, 3154 (1999).


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