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Nucleonic Shells: a Paradigm Shift?[1] WITOLD NAZAREWICZ, University of Tennessee/ORNL — Shell structure is a fundamental property of leptodermous finite Fermi systems. It results from a one-body motion of weakly interacting quasi-particles in an average mean-field potential. The concept of single-particle motion in nuclei, developed in the late forties, is a cornerstone of nuclear structure. But how robust is this concept? A significant new theme concerns shell structure near the particle drip lines and in the superheavy nuclei. Theoretical predictions and experimental discoveries in the last decade indicate that nucleonic shell structure is being recognized now as a more local concept. It is already known that the magic numbers in light neutron-rich nuclei are not the immutable benchmarks they were once thought to be. The existence of loosely bound nuclei near the drip lines crucially depends on many-body correlations that are impacted by the presence of the low-lying continuum of unbound nuclear states that can decay by particle emission. In the superheavy elements that owe existence to quantum stabilization, the familiar localization of shell effects at magic numbers is basically gone. The study of very exotic nuclei at the limits of isospin and mass will provide the missing links in our present understanding.

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