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Nuclear Halo and Shell Evolution along the Neutron Drip Line

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Nuclear halo is a weakly-bound exotic state of nuclear matter where one or two valence neutrons extend far beyond the nuclear potential well. We present recent experimental results on halo nuclei, using Coulomb and nuclear breakup. In the first part, we show experimental results on Coulomb breakup of ^{11}Li, where observed three-body energy spectrum allows us to discuss the di-neutron correlation of this nucleus. In the second part, we show the results of nuclear breakup of ^{14}Be where its Borromean constituent ^{13}Be structure is revealed. We discuss the shell melting of this unbound nucleus. In the third part, we show the most recent results on the inclusive breakup reactions of ^{22}C and ^{31}Ne at 230MeV/nucleon using the newly commissioned RI-beam facility RIBF (RIKEN RI-Beam Factory) at RIKEN. These nuclei are candidates of halo nuclei, located heavier than the known halo nuclei. We have observed enhancement of the Coulomb and nuclear breakup cross sections of these two nuclei, suggesting that these nuclei have halo structures. The detailed comparison of the observed cross sections and calculation shows that ^{31}Ne has a halo property as well as shell vanishing in nature.