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Neutron Dripline for Magnesium nuclei and hypernuclei

CHHANDA SAMANTA, Virginia Military Institute, Lexington, VA, USA, TORSTEN SCHUERHOFF, STEFAN SCHRAMM, Frankfurt Institute for Advanced Studies, ITP, Frankfurt, Germany — Hypernuclei containing lambda (Λ)-hyperons are of current interest in nuclear as well as astro-physics. The effect of addition of a Λ-hyperon on the neutron-dripline of a Magnesium nucleus is investigated in a microscopic framework using the Frankfurt chiral effective model. The chiral flavor-SU(3) yields a good fit to nuclei as well as reproduces 2-solar-mass neutron stars. In this model, we find that the neutron dripline is at ^{42}Mg. If a Λ-hyperon is added, it opens up an additional degree of freedom, allowing for a wider energy distribution, and leads to a dripline at $^{51}_{\Lambda}$Mg. The general behavior of additional binding is expected in hyper-nuclei; however the size of the shift is quite striking. When the calculations are repeated with the SPL-40 and NL-3 parameter sets, the dripline nuclei without and with a Λ-hyperon are found to be ^{52}Mg and $^{47}_{\Lambda}$Mg (for SPL-40) and ^{46}Mg and $^{47}_{\Lambda}$Mg (for NL3), respectively. The last experimentally measured nucleus of the Mg isotope chain is ^{40}Mg which, according to a macroscopic model, is the last bound neutron-rich Mg-isotope. The macroscopic and all three microscopic models well describe the measured Λ-separation energy of all $\Lambda-$hypernuclei. But, the results near the drip line are found to be very model dependent. Especially, while the SU(3) model suggests that the addition of a Λ-hyperon leads to an outward shift of the dripline by 8 neutrons, the SPL-40 model indicates an inward shift by rejecting 6 neutrons. Both results are remarkable and calls for experimental verification.

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