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Bound and unbound light nuclei from *ab initio* theory

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One of the recently developed approaches capable of describing both bound and scattering states in light nuclei simultaneously is the No-Core Shell Model with Continuum (NCSMC) [1,2]. I will present latest NCSMC calculations of weakly bound states and resonances of exotic halo nuclei such as ${}^6\text{He}$ and ${}^{11}\text{Be}$ and discuss strong E1 transitions and photo-dissociation of ${}^{11}\text{Be}$. I will also present our results for unbound nuclei such as ${}^7\text{He}$, ${}^9\text{He}$ and ${}^{11}\text{N}$ and highlight the role of chiral NN and 3N interactions. Finally, I will review our recent results for $A=12$ nuclei with ${}^{12}\text{N}$ calculated including its ${}^{11}\text{C}+p$ breakup channel and discuss the role of E1 excitations in ${}^{12}\text{C}$ in experimental determination of its 2^+ quadrupole moment.

[1] S. Baroni, P. Navratil, and S. Quaglioni, Phys. Rev. Lett. **110**, 022505 (2013); Phys. Rev. C **87**, 034326 (2013).

[2] P. Navratil, S. Quaglioni, G. Hupin, C. Romero-Redondo, A. Calci, Physica Scripta **91**, 053002 (2016).

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