Evidence for Three-Nucleon Interaction in Isotope Shifts of Z = Magic Nuclei

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While the ℓs splitting plays an essential role in nuclear shell structure, its origin has not been understood well. It has recently been pointed out that the $3N$ interaction derived by the chiral EFT, which effectively adds a density-dependent term to the LS channel, may account for the missing part of the ℓs splitting [1]. In this talk I show that the kink in the isotope shifts of the Pb nuclei, another long-standing problem, may be solved also with the $3N$ (i.e. density-dependent) LS interaction. I shall exemplify it by the semi-realistic M3Y-P6a interaction [2], the LS-modified variant of M3Y-P6 [3]. Moreover, the almost equal charge radii between ^{40}Ca and ^{48}Ca are well described with M3Y-P6a [4], which has been difficult to be reproduced with the MF calculations so far. While the isotope shifts of the Sn nuclei are in good agreement with the known data, a kink is predicted at $N = 82$ with M3Y-P6a in contrast to the effective interactions without density-dependent LS channels. This could be a touchstone for the $3N$ LS effects.

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References

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