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Séminaire

PHYSIQUE NUCLÉAIRE
NUCLEAR PHYSICS

The complexity of nuclear structure towards neutrinoless double beta decay

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Zoom:
https://ijclab.zoom.us/j/95343289678?pwd=clN4aDQxTjFpbGZQMmFwUUZMWFJZZz09

I will present a recent study on Gamow-Teller (GT) strengths in the doubly–magic nuclei ^{48}Ca and ^{78}Ni. These strengths are obtained with the self–consistent charge–exchange subtracted second random–phase approximation (CE-SSRPA). The agreement of the predicted GT strength with the corresponding experimental distribution in ^{48}Ca is significantly improved, compared with other available theoretical predictions where the Ikeda sum rule, integrated up to an excitation energy of 20-30 MeV, is systematically overestimated with respect to the experimental measurement. When this overestimation occurs, it is customary in the theoretical models to resort to *ad-hoc* quenching factors for the GT operator.

I will show that (and I will explain how), for the first time, the experimental quenching of the Ikeda sum rule could be well accounted for in ^{48}Ca without adopting *ad-hoc* factors with the CE-SSRPA model. This achievement has important implications for future applications of the CE-SSRPA model to the evaluation of the nuclear matrix elements (NMEs) entering in neutrinoless-double-beta ($0\nu\beta\beta$) decay halflives, for example in ^{48}Ca, which is expected to be the lightest $\beta\beta$ emitter. The mechanisms underlying GT resonances and β decays have a deeply different nature. Nevertheless, a GT-type term turns out to be the leading contribution in the $0\nu\beta\beta$-decay NMEs. Hence, for the sake of coherency, a prediction of NMEs (adopting the bare value of the axial-vector coupling g_A) would be regarded as more reliable if obtained with a model which does not need *ad-hoc*-quenched GT operators to correctly describe experimental GT strengths.

The final part of this talk will be dedicated to ongoing developments aimed to extend our analyses of GT strengths to other nuclei, spanning different zones of the nuclear chart.

D. Gambacurta, M. Grasso, and J. Engel, Gamow-Teller Strength in ^{48}Ca and ^{78}Ni with the Charge-Exchange Subtracted Second Random-Phase Approximation, Phys. Rev. Lett. 125, 212501 (2020)