Int. Workshop “Shapes and Dynamics of Atomic Nuclei: Contemporary Aspects”
ed. Nikolay Minkov, Heron Press, Sofia 2017

Models with spatially unfavoured bosons

P. Van Isacker[1]

[1]Grand Accélérateur National d’Ions Lourds, CEA/DRF-CNRS/IN2P3,
Boulevard Henri Becquerel, B.P. 55027, F-14076 Caen, France

Abstract

In two recent papers Fujita *et al.* [1] report on results of (^{3}He,t) charge-exchange experiments that determine Gamow–Teller (GT) strength in nuclei with mass numbers $A = 42$, 46, 50 and 54. They observe a concentration of most of the GT strength in the lowest 1^+ state at 0.611 MeV in the $^{42}\mathrm{Ca} \rightarrow {}^{42}\mathrm{Sc}$ reaction. In parallel, also results of deuteron-transfer experiments in this region of the nuclear chart have become available [2]. In this talk I propose an explanation of the charge-exchange and deuteron-transfer results in terms of a model that assumes nucleons in two orbitals with radial quantum number n, orbital angular momentum l and total angular momenta $j = l \pm 1/2$ [3].

This fermionic model defines elementary modes, in terms of which a boson model can be constructed. A long time ago Elliott and co-workers showed that an isospin-invariant version of the interacting boson model (IBM) with s and d bosons [4] could be constructed in terms of isovector bosons (IBM-3) [5] or of both isoscalar and isovector bosons (IBM-4) [6]. In the models considered to date all bosons correspond to nucleon pairs in spatially symmetric states, *i.e.*, to two-nucleon configurations that are favoured under SU(4). The bosonic model based on charge-exchange and deuteron-transfer data indeed contains the bosons of IBM-4 but also a p ($L = 1$) isovector boson, which corresponds to a spatially unfavoured fermion pair. Its presence is an inevitable consequence of the spin-orbit interaction. Some algebraic properties of models with spatially unfavoured bosons are discussed.

References

[1] Y. Fujita *et al.*, *Phys. Rev. Lett.* **112** (2014) 112502; *Phys. Rev. C* **91** (2015) 064316.

[2] A.O. Macchiavelli *et al.*, to be published.

[3] P. Van Isacker and A.O. Macchiavelli, to be published.

[4] F. Iachello and A. Arima, *The Interacting Boson Model*, Cambridge University Press, Cambridge (1987).

[5] J.P. Elliott and A.P. White, *Phys. Lett. B* **97** (1980) 169.

[6] J.P. Elliott and J.A. Evans, *Phys. Lett. B* **101** (1981) 216.