Is it Possible to Use Valence Space Techniques for Calculating QRPA Vibrational Mass Parameters? Convergence Considerations

F. Lechaftois[1], **I. Deloncle**[1,2], **S. Péru**[1,2]

[1]CEA, DAM, DIF 91680 Arpajon, FRANCE
[2]CSNSM, IN2P3/CNRS, 91405 Orsay Campus, FRANCE

The vibrational mass parameters entering the 5DCH quadrupole hamiltonian are commonly calculated in the cranking approximation, neglecting the dynamical modification of the self-consistent field [1].

In the QRPA framework such field modification is taken into account, opening the way to vibrational mass parameter calculated la Thouless-Valatin.

Unfortunately, solving the 5DCH equations requires to perform QRPA calculations on every point of a (β,γ) grid. This a priori excludes such an approach due to prohibitve calculation time when using Gogny interactions [2]. However, in a recent study [3] we investigated the use of a valence space as a technics for reducing the QRPA mass parameter computation time. The valence space is imposed through a limit in the two quasi-particle excitation energy and by the inclusion of an inert core. The convergence properties of the vibrational mass parameter as a function of the energy cutoff value and of the inert core size have been checked and compared with those of QRPA excited state energy and electromagnetic transition probabilities. The conclusions of these convergence tests will be drawn. Using both energy cutoff and an inert core allows to reduce up to a factor of 30 mass parameter computation time. It is worth noting that the inert core technique should be avoided for intrisic QRPA output calculation. For the latters, as for mass parameters the convergence process appears delicate due to deceptive appearances.

References

[1] J.P. Delaroche, M. Girod, J. Libert, H. Goutte, S. Hilaire, S. Péru, N. Pillet and G.F. Bertsch, *Phys. Rev. C* **81** (2010) 014303.

[2] S. Péru and H. Goutte, *Phys. Rev. C* **77** (2008) 0044313.

[3] F. Lechaftois, I. Deloncle and S. Péru, "Introduction of a valence space in QRPA: impact on vibrational mass parameters and spectroscopic properties" *submitted to Phys. ReV. C*