INTRINSIC VORTICAL CURRENTS AND ROTATIONAL BANDS IN WELL DEFORMED NUCLEI

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In a series of papers [1] it has been demonstrated quantitatively, some years ago, that the effect of pairing correlations on the global rotation of well deformed nuclei was to generate counter-rotating intrinsic vortical currents fully defined by the expectation value of the so-called Kelvin circulation operator. It has been further established that the time-derivative of the angle canonically conjugated to the latter operator could be very well be approximated as a simple polynomial of degree three with respect to the corresponding angular velocity Ω.

Of course, this approach is only able to reproduce the behaviour of pairing correlated rotational states in regions where the quenching of the rotational motion has a purely collective origin (as in the description due to Mottelson and Valatin [2], analogous to the physics of type 1 supraconductors). Similarly it is clearly unable to deal with rotationally induced deformation effects (rotational stretching) thus reserving this approach to well (rigidly) deformed nuclear states

In this contribution, we take stock of these results to propose a simple polynomial formula relating the energies of rotational states to the relevant Ω values. This approach needs only to resort to a single normalization input parameter which is the 2^+ state energy of the considered rotational band.

As it will be shown, one obtains with the above simple approach a rather good reproduction of rotational energies e.g. for ground bands throughout and around the actinide region. Our results will also be compared with those of another simple formula proposed two years ago in reference [3].

[1] P. Quentin, H. Lafchiev, D. Samsoen and I.N. Mikhailov, Phys. Rev. C 69, 054315 (2004).

[2] B.R. Mottelson and J.G. Valatin, Phys. Rev. Lett. 5, 11 (1960).

[3] B. Nerlo-Pomorska, K. Pomorski and J. Bartel, Phys. Rev. C 84, 044310 (2011).