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The Effect of Neutron-Proton Configuration on the γ-Instability of Nuclear Deformation

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The effect of neutron-proton configuration on the γ-instability of nuclear deformation is discussed on a simple $2j$ model with a single j shell for neutrons and another j for protons. Under a pairing plus strong QQ force, the single j model with identical particles always gives deformation which is negative at the beginning of the shell and positive at the end of the shell. When two kinds of particles are present, however, the following configuration is also allowed, *i.e.* the protons start to fill one shell (in consequence, the proton density tends to deform oblately) and the neutrons almost fill up another shell (prolate deformation) or vice versa. In this case, the symmetry axes for these particles may become perpendicular to each other due to the attractive neutron-proton interaction and the system is expected to be quite unstable in the γ-direction.[1] In order to see this clearly, the deformation energy is calculated by the Nilsson (including the Y_{22} and Y_{2-2} terms) plus BCS method. Our pairing plus QQ force is the same as that of Baranger and Kumar.[2] This force leads to the spherical minimum in the single j model because of its moderate strength. In the $2j$ model, however, it gives rise to the deformed minimum as illustrated in Figs. 1 and 2. Figure 1 shows that the system is γ-unstable in a configuration mentioned above, while Fig. 2 shows an axial symmetry of the system when both proton and neutron shells are almost filled up. Although our model is very simple, it sheds some light on the understanding of quasi band structures.[3] The author is very grateful to Prof. N. Ohnishi, Prof. K. Ikeda, Prof. M. Kawai and Dr. K. Ogawa for useful comments.

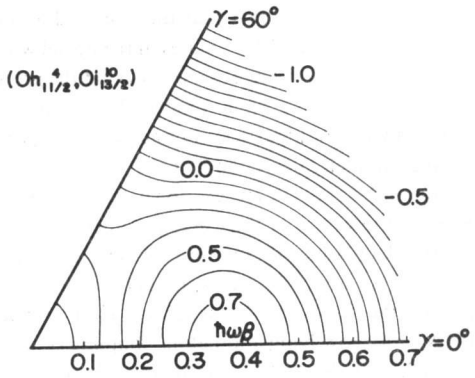

Fig. 1.

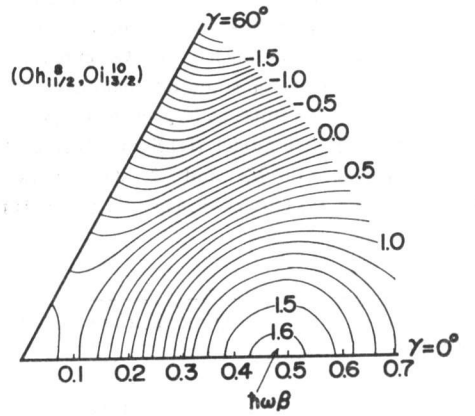

Fig. 2.

Contour maps of the binding energy in $(BE/G_p - 16)$. These figures are drawn for $G_p = 0.175$ MeV, $G_n = 0.143$ MeV and $G_{QQ} = 0.055$ MeV.

References

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2) M. Baranger and K. Kumar: Nuclear Phys. **62** (1965) 113, **A110** (1968) 490; K. Kumar and M. Baranger: Nuclear Phys. **A110** (1968) 529.
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