乞掲示

理化学研究所原子核グループコロキウム *2002. 11. 12*

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題目： Spontaneous Symmetry Breaking in Rotating Nuclei: Chiral Doublet Bands

∗ The seminar will be given in *English.*

日時： 2002年 11月 12日 (Tue.) 13:30 –

場所： RIKEN Main Bldg. 2F Seminar Room

Abstract

The discovery of an island of nuclear chirality[1], involving the N=73, 75 odd-odd isotones in the A∼130 region, has now been well documented. Structures in this region involving a triaxial core with high-j unique parity ($h_{11/2}$) valence-particle and -hole orbitals form a near mutually perpendicular coupling of the core rotation and valence nucleon angular momenta. This geometry, which minimizes the total energy, introduces a handedness (chirality) in the intrinsic frame. Since the nuclear Hamiltonian is necessarily chiral (time reversal) symmetric, doubly degenerate energy eigenstates are produced. The formation of such a nuclear chiral geometry exemplifies spontaneous symmetry breaking. The manifestation of this phenomenon in the A∼130 region is the existence of nearly degenerate ΔI=1 rotational bands built on the $\pi h_{11/2} \otimes \nu h_{11/2}$ configuration.

In this talk, a summary will be given for experimental investigations of nuclear chirality in the A ∼ 130 region at the NSL at Stony Brook as well as experiments using the GAMMASPHERE and EUROBALL arrays. This also includes experiments attempting to populate high-spin states in neutron-rich odd-odd nuclei. Experimental systematics in odd-odd Cs isotopes will be presented and discussed in terms of triaxiality using two theoretical approaches.

As this study has demonstrated, chiral conditions showing the doubling of rotational states can only be found in rather limited regions of the nuclear chart and over specific spin ranges. Its existence, however, provides strong and clear evidence for triaxial nuclear shapes. To explore the physics involving triaxial shapes, chirality was investigated in terms of the properties of the two lowest energy eigenstates obtained by a particle plus triaxial rotor model extended to odd-odd nuclei. In this model, a rigid rotor with irrotational flow moments of inertia was used. The fact that two of the three principal axis moments of inertia are equal at maximum triaxiality (γ=30°) was exploited in the calculations. Furthermore, thequantization axis was chosen to coincide with the intermediate principal axis, along which the moment of inertia is maximum and thus the preferred axis for collective rotation. These two imposed conditions led to significantsimplifications in the wave functions despite the large number of basis states.

The above approach was found to be very useful for the recognition of systematic patterns in experimental observables, which result from triaxiality. However, for more precise quantitative investigations, the Kerman-Klein-Dönau-Frauendorf method was employed. Results of the model calculations for ^{128}Cs will be presented [2].

1. K. Starosta *et al.*, Phys. Rev. Lett. **86**, 971 (2001); T. Koike *et al.*, Phys. Rev. C **63**, 061304(R) (2001).
2. T. Koike *et al.*, to be submitted to Phys. Rev. C.

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