A STUDY OF THE ELECTROMAGNETIC MOMENTS OF THE NUCLEI ^{19}F, ^{19}Ne, ^{21}Ne, ^{21}Na, ^{23}Na and ^{23}Mg WITH THE GENERATOR COORDINATE METHOD*

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ABSTRACT

The collective properties of even parity excited states of minor nuclei are studied.

Experimental data and several calculations show that most of light nuclei with valence nucleons within 1d-2s shell are deformed although the collective degrees of freedom are not always very distinctive. It turns out[1,2] that because of this collective nature, the generator coordinate method (GCM) gives for these nuclei results which are in very good agreement with the results of complete diagonalization, althrough the GCM ussually works in a very small part of the model space-with five or six basic functions.

In the generator coordinate method we use the trial function

$$\Psi^J(\underline{x}) = \sum_k \sum_{ij} f_k^J(\beta_i,\mu_j)\ \hat{P}^J \Phi_k(\beta_i,\mu_j,\underline{x}),$$

where $\Phi_k(\beta_i,\mu_j,\underline{x})$ are Slater determinants of N single particle functions, defined with the Hamiltonian:

$$\hat{h} = \hbar\omega_0 \frac{1}{2}(-\nabla^2 + r^2) + \hbar\omega_0 \beta r^2 Y_{20} + C\vec{l}\vec{s} + \mu Cl^2.$$

Index k indicates different configurations. We solve the N-body problem by means of the variational principle.

The purpose of this paper is(i)to see what one can learn about mirror nuclei ^{19}F, ^{19}Ne, ^{21}Ne,^{21}Na, ^{23}Na, and ^{23}Mg through their electromagnetic moments, (ii) which features are adquately given by GCM.

In Fig. 1 we present magnetic dipole moments of the nuclei ^{21}Ne, ^{21}Na, ^{23}Na and ^{23}Mg, calculated with the GCM using the KUO and the Preedom-Wilthental (PW) effective interaction. We present those of even-parity excited states, which tentatively belong to k=3/2 band. For comparison the results, obtained by mixing different HF-determinat[2] (PHF), the results of complete diagonalization (CD), the results of Arima[3] and Glasgow group[4], and experimental data are presented where available. All the results are presented in such a scale that they would lie on straight lines if the excited states follow the simple Bohr-Mottelson's model.

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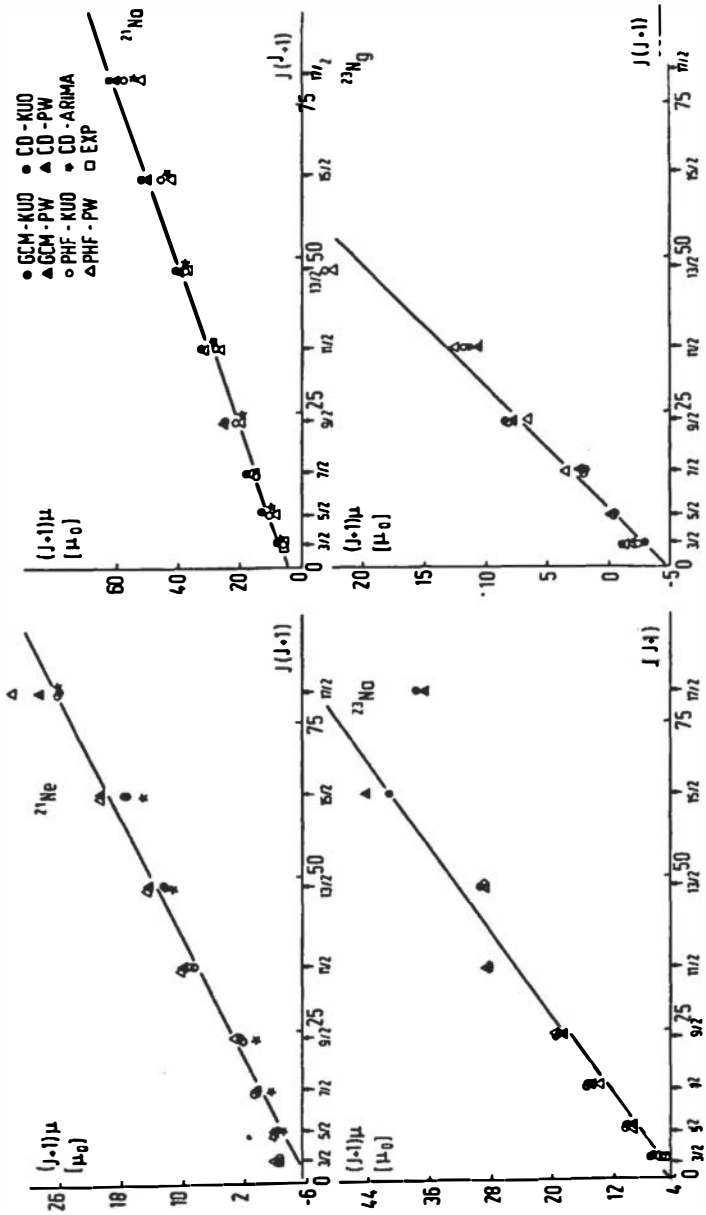

Fig. 1

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