THE INVESTIGATION OF DIPOLE EXCITATIONS IN DOUBLE-EVEN ^{182}W AND ^{184}W NUCLEI AT THE SPECTROSCOPIC ENERGY REGION

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The dipole excitations of double-even ^{182}W and ^{184}W nuclei are studied using the rotational and translational invariant quasiparticle random phase approximation (QRPA) model [1]. There, by the selection of suitable separable effective isoscalar and isovector forces, without introducing additional parameters, rotational invariance is restored for the description of the M1 modes as well as translational invariance for the calculation of E1 excitations. This approach gives an opportunity to test the validity of the present theory and interpret the experimental states with unassigned spins and parity in less-deformed transitional nuclei. Theory predicts magnetic dipole $K^{\pi} = 1^{+}$ levels for the 2–4 MeV interval with a summed M1 widths $\sum \Gamma_0^{red}(M1) = 10.2$ meV for ^{182}W and $\sum \Gamma_0^{red}(M1) = 5.3$ meV for ^{184}W where our orbit-to-spin ratio analysis shows most of the levels have a high orbit-to-spin ratio $|M_l/M_s|>1$ and belong to the scissors mode states. The contribution of these states to the total dipole transition width is about 80% below 4 MeV. The experimental summed widths for the $K^{\pi} = 1^{+}$ states in the same energy interval are $\Sigma\Gamma_0^{red}(\text{exp.})=7.13\pm1.26$ meV [2] and $\Sigma\Gamma_0^{red}(\text{exp.})= 4.73\pm1.28$ meV [2] for ^{182}W and ^{184}W, respectively. The calculated M1 summed width for scissors mode compares reasonably with experimentally obtained summed width. Though the calculated summed M1 excitations strength is higher than that of experimental data, possible reason for this discrepancy could be that the strength in this nuclei is so fragmented that a part of it might have just escaped detection in experiment [2].On the other hand, several well pronounced electric dipole excitation with K=1 in spectroscopic region where mainly filled with M1 dipole states is predicted. The total E1 widths for K=1 is $\sum \Gamma_0^{red}(E1) = 1.2$ meV for ^{182}W and $\Sigma\Gamma_0^{red}(E1) = 2.62$ meV for ^{184}W, quite close to the corresponding experimental value with K=1 $\Sigma\Gamma_0^{red}(\text{exp.})=0.94\pm0.18$ meV [2] and $\Sigma\Gamma_0^{red}(\text{exp.})= 2.05\pm0.59$ meV [2]. The theory also indicates the presence of a few weekly collectivized magnetic and electric dipole levels with K=0. The contributions of these states to the summed magnetic and electric dipole decay widths are about %7.

References

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