Project Title:

Properties of finite systems including nuclei at high temperature and angular momentum (Properties of highly excited nuclei)

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1) **Description of the GDR width at finite temperature and angular momentum**

The line shapes of giant dipole resonance (GDR) in the decay of the compound nucleus ^{88}Mo, which is formed after the fusion-evaporation reaction ^{48}Ti + ^{40}Ca at various excitation energies E* from 58 to 308 MeV, are generated by averaging the GDR strength functions predicted within the phonon damping model (PDM) using the empirical probabilities for temperature and angular momentum. The average strength functions are compared with the PDM strength functions calculated at the mean temperature and mean angular momentum, which are obtained by averaging the values of temperature and angular momentum using the same temperature and angular-momentum probability distributions, respectively. It is seen that these two ways of generating the GDR linear line shape yield very similar results. It is also shown that the GDR width approaches a saturation at angular momentum $J \geq 50\hbar$ at T= 4 MeV and at $J \geq 70\hbar$ at any T.

2) **Demonstration of the importance of exact pairing in the description of pygmy dipole resonance**

The strength functions of giant dipole resonance (GDR) in oxygen $^{18-24}$O, calcium $^{50-60}$Ca, and tin $^{120-130}$Sn isotopes are calculated within the phonon damping model under three approximations: without superfluid pairing, including BCS pairing, and exact pairing gaps. The analysis of the numerical results shows that exact pairing decreases the two-neutron separation energy in light nuclei, but increases it in heavy nuclei as compared to that obtained within the BCS theory. In neutron-rich medium and heavy nuclei, exact pairing significantly enhances the strength located at the low-energy tail of the GDR, which is usually associated with the pygmy dipole resonance (PDR). The line shape of the GDR changes significantly with increasing the neutron number within an isotopic chain if the model parameter is kept fixed at the value determined for the stable isotope.

Fiscal Year 2013 List of Publications Resulting from the Use of RICC

[Publication]

1) N. Dinh Dang and N. Quang Hung, On the importance of using exact pairing in the study of pygmy dipole resonance, J. Phys. G 40 (2013) 105103.

2) N. Dinh Dang, M. Ciemala, M. Kmiecik, and A. Maj, Giant dipole resonance in ^{88}Mo from phonon damping model's strength functions averaged over temperature and angular momentum distributions, Phys. Rev. C 87 (2013) 054313.

[Proceedings, etc.]

(do not contain acknowledgments because of page limitation)

3) N. Dinh Dang, Damping of giant dipole resonance in highly excited nuclei, Acta Physica Polonica B 44 (2013) 595.

4) N. Dinh Dang, Giant dipole resonance in highly excited nuclei, arXiv:1309.3345, to appear in the Proceedings of the Int'l. Nucl. Phys. Conf. INPC 2013, 2 - 7 June, 2013, Florence, Italy.

[Oral presentation at an international symposium]

1) N. Dinh Dang, Giant dipole resonance in highly excited nuclei,
oral contribution at the International Nuclear Physics Conference INPC 2013, June 2 - 7, 2013, Florence, Italy.

2) N. Dinh Dang, Viscosity: From air to hot nuclei,
invited plenary lecture at International Symposium on Nuclear Physics organized by the Bhabha Atomic Research Center (BARC) in Mumbai on Dec. 2 – 6, 2013.

3) N. Dinh Dang, Giant dipole resonance from phonon-damping model's strength functions averaged over temperature and angular momentum,
invited seminar at SINP, Dec. 9, 2013.