Giant dipole resonance in highly excited nuclei

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The evolution of the giant dipole resonance's (GDR's) width and shape at finite temperature and angular momentum is described within the framework of the phonon damping model (PDM)[1], developed by the author and collaborators.

The PDM generates the damping of GDR through the couplings of GDR to particle-hole (ph) configurations, which cause the quantal width, and to particle-particle (pp) and/or hole-hole (hh) configurations, which cause the thermal width. The quantal width decreases slightly as temperature T increases, whereas the thermal with increases with T and saturates at high T. This leads to an overall increase in the GDR's total width at low and moderate T, and its saturation at high T. At very low T (below 1 MeV) the GDR's width remains nearly constant because of thermal pairing.

The PDM description is compared with the established experimental systematic obtained from heavy-ion fusion and inelastic scattering of light particles on heavy target nuclei, as well as with predictions by other independent theoretical approaches. In a recent development, the PDM has been extended to include the effect of angular momentum and its description is compared with the most recent preliminary experimental results of GDR in hot rotating Mo-88 nucleus. The predictions by PDM and the heavy-ion fusion data are also employed to predict the viscosity of hot medium and heavy nuclei. Very recently the PDM strength functions have been averaged over the probability distributions of temperature and angular momentum for the heavy-ion fusion-evaporation reaction, which forms the compound nucleus ^{88}Mo at high temperatures and angular momenta. The results of theoretical predictions are found in excellent agreement with the experimental data.

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[1] N. Dinh Dang and A. Arima, Phys. Rev. Lett. **80**, 4145 (1998); N. Dinh Dang and A. Arima, Nucl. Phys. **A 636**, 427, (1998); N. Dinh Dang and A. Arima, Phys. Rev. **C 68**, 044303 (2003); N. Dinh Dang, Phys. Rev. **C 85**, 064323 (2012); N. Dinh Dang and N. Quang Hung, Phys. Rev. **C 86**, 044333 (2012).