Unitarity of the particle-hole dispersive optical model

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Within a recently developed particle-hole dispersive optical model (PHDOM) the main relaxation modes of high-energy particle-hole-type nuclear excitations are commonly taken into account [1]. In connection with the description of isoscalar monopole (ISM) excitations within the PHDOM (first results are obtained in [2]) the question of violation of the model unitarity arises. The source of the violation is the use of the optical-model Green functions. The latter satisfy equations that contain an optical-model energy-dependent term (having imaginary and real parts) which is added to the nuclear mean field. The signatures of violation are: (i) a non-zero value of the calculated strength function $S_1(\omega)$, corresponding to the "spurious" external field $V_1(r) = 1$ (the general expression for an isoscalar monopole (ISM) external field is $V(\vec{r}) = V(r)Y_{00}(\vec{n})$); (ii) negative values of the strength function $S_{r^2}(\omega)$ at high excitation energies ω, that leads to underestimation of the corresponding energy-weighted sum rule.

To restore unitarity of the model, we properly modify the energy-averaged ISM double transition density by adding to it a term involving the ground-state density normalized to unity. As a result, we get: (i) the zero value for the modified "spurious" strength function; (ii) the modified ISM strength functions, which are now evaluated for the modified external field $V(r) - \bar{V}$, with averaging over the ground-state density. Calculations are being performed for ^{208}Pb.

[1] M.H. Urin, Phys. At. Nucl. 2011. V.74. p.1189; Phys. Rev. C. **87**, 044330 (2013).
[2] M.L. Gorelik, S. Shlomo, B.A. Tulupov, and M.H. Urin, NUCLEUS 2014, Books of Abstracts, p.143; Phys. At. Nucl. 2015 (in press).