The isovector giant dipole resonance and the neutron skin in ^{208}Pb

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A recent high-resolution measurement [1] of the isovector giant dipole resonance (IVGDR) strength distribution in ^{208}Pb leads to an accurate value for the electric dipole polarizability α_D, which is directly related to the inverse energy moment m_{-1} of the strength function of the IVGDR. The value of α_D in ^{208}Pb was then used in this work to determine the magnitude of the neutron skin thickness, the difference $r_n - r_p$ between the root mean square (rms) radii of the neutron and proton density distributions in this nucleus, resulting in the value of $r_n - r_p = 0.156$ (.025) fm. However, the analysis in this work was based on only one form of energy density functional (EDF), associated with a specific parameterization of the Skyrme interaction. To examine the conclusion of the work of Ref. [1], HF calculations of the neutron skin thickness, $r_n - r_p$, and fully self-consistent HF-based RPA calculations of the electric dipole polarizability of ^{208}Pb were carried out [2] using 34 commonly employed Skyrme type interactions. Fig. 1 shows the predictions of the 34 Skyrme interactions for the polarizability α_D as a function of the neutron skin, $r_n - r_p$, in ^{208}Pb. The experimental data [1] on α_D is shown as the region between the dashed lines. Also shown is the Pearson correlation coefficient $C_{AB} = 0.54$, which indicates a weak correlation between α_D and $r_n - r_p$. One thus concludes that EDFs associated with theoretical predictions of values of $r_n - r_p$ in

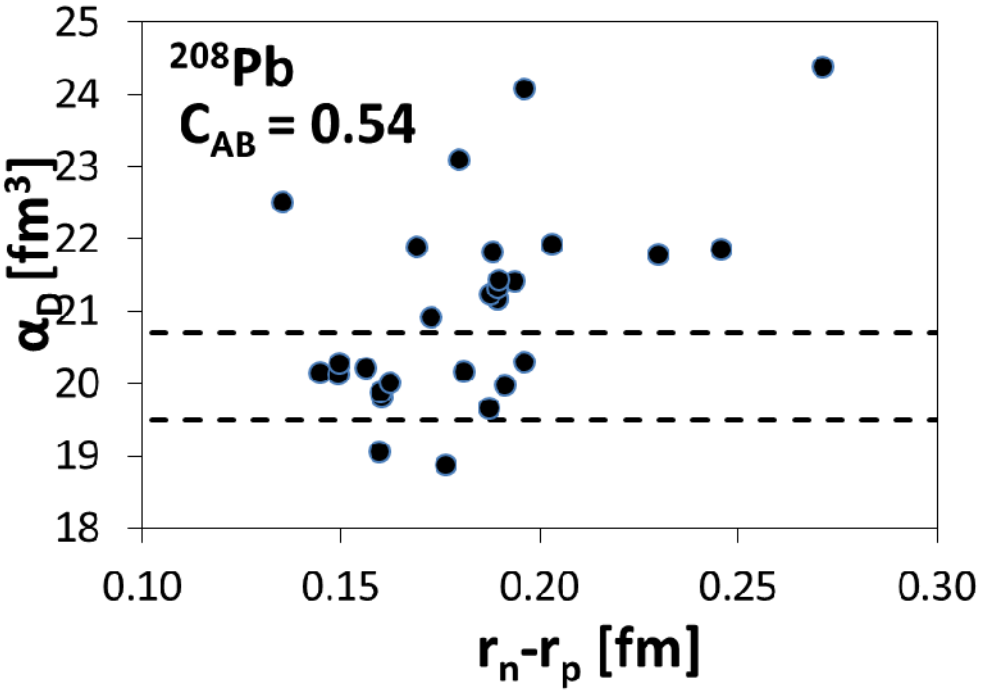

FIG. 1. The IVGDR polarizability α_D as a function of $r_n - r_p$ in ^{208}Pb. The experimental data on α_D [1] are shown as the region between the dashed lines. The results of fully self-consistent HF-based RPA calculation of 34 commonly used Skyrme interactions [2] are shown as solid points. Also shown is the Pearson correlation coefficient C_{AB}.

the range of 0.14 to 0.20 fm are all consistent with the experimental data on α_D.

[1] A. Tamii *et al.*, Phys. Rev. Lett. **107**, 062502 (2011).
[2] M.R. Anders *et al.*, in preparation.