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Calculation of the isotope shift in neutral atoms

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One of the most interesting properties of an atomic nucleus is its root-mean-square charge radius. This quantity can be measured using several different types of experiments. One of them is the observation of an isotopic shift in atomic spectra. An important feature of this method is the ability to determine the radii of short-lived nuclei. To find the radius from experimental data for one transition, mass and field shift constants turn out to be necessary. We have developed a new approach and calculated these constants for a number of the gold atom isotopes. An important feature of the calculations was a detailed analysis of the theoretical uncertainties. It was demonstrated that the use of modern methods for calculating the electronic structure makes it possible to achieve a high accuracy for the gold atom under consideration surpassing accuracy previous studies. The present calculations have been supported by the Russian Science Foundation Grant 19-72-10019.

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