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# Construction of Nuclear Level Filling Schemes Using the Woods–Saxon Potential Based on ENSDF Data

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Modern nuclear databases such as NuDat 3 and ENSDF provide extensive experimental information on level energies, spins, parities, and decay modes. However, these databases lack tools for automated comparison with theoretical predictions and do not provide complete single-particle level schemes, particularly for exotic nuclei far from stability. In this work, we present a systematic study of nuclear level structures for isotopes with Z = 10–72 using the realistic Woods–Saxon potential. The potential parameters are determined using the Bohr–Mottelson systematics. The radial Schrödinger equation is solved numerically using the high-accuracy Numerov method. A software module for NATI (Nuclide Analysis and Technical Interface) has been developed. The module automatically constructs single-particle level filling schemes and exports results in JSON, CSV, and SVG formats. It includes automated comparison with experimental data from ENSDF. The methodology has been validated for three reference nuclei: 40Ca (Z = 20, N = 20), 56Fe (Z = 26, N = 30), and 116Sn (Z = 50, N = 66). The calculated magic gaps of 6.4 MeV, 7.6 MeV, and 7.9 MeV are in good agreement with experiment. The average deviation between theoretical and experimental single-particle energies is 0.4–0.7 MeV. The developed tool provides a data-ready approach for nuclear structure analysis and can be applied for predictive filling of gaps in experimental data, particularly for exotic nuclei with only 1–5 known levels. Keywords: Woods–Saxon potential, nuclear shell model, ENSDF, Numerov method, nuclear level schemes

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