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On spl (5, 5) super-symmetric Eigen vectors of the 5D discrete Fourier transform

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An explicit form of a discrete analogue of the quantum number operator is constructed in terms of the different lowering and raising operators that govern Eigen vectors of the 5D discrete (finite) Fourier transform. This discrete number operator has distinct Eigen values, which are employed to systematically classify Eigen vectors of the 5D discrete Fourier transform, thus avoiding the ambiguity caused by the well-known degeneracy of the Eigen values of the latter operator. It is found that the hidden symmetry of the discrete number operator manifests itself in the form of the Lie super algebra spl (5, 5).

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Determination of nuclear charge radii using atomic laser spectroscopic measurements

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High resolution laser spectroscopic measurements of transition frequencies, isotope shifts, etc., are now at a level that they are sensitive to the charge radius of the nucleus. Hence, the recent interest in the discrepancies in the determination of the proton charge radius. A number of experiments have employed novel spectroscopic techniques to measure isotope shifts for several transitions at optical frequencies for the stable and radioactive lithium isotopes. These data offer an important test of theoretical techniques developed by several groups to accurately calculate QED effects and the finite nuclear size in 2 and 3 electron atoms. Theory and experiment have studied several transitions in both Li⁺ and neutral lithium. The work by multiple groups permits a critical examination of the consistency of separately, the experimental work as well as theory. Combining measured isotope shifts with calculated energy shifts passing these consistency tests, permits the determination of the relative nuclear charge radius with an uncertainty approaching 1x10⁻¹⁸meter. These results are about two orders of magnitude more accurate than those obtained by electron scattering experiments and give insight into the mass and charge distributions of the nuclear constituents.

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