NEW RESULTS ON THE STRUCTURE OF BARYONS AND THEIR EXCITATIONS FROM LATTICE QCD

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This presentation will focus on recent advances in understanding the fundamental structure of baryons and their low-lying excitations from the first principles approach of Lattice QCD. Specific topics include new advances in determining the magnetic polarizabilities of the nucleon. Here, novel methods incorporating the Landau modes experienced by the individual quarks within the nucleon are enabling the determination of the polarizability with unprecedented accuracy. Similarly, novel methods for isolating boosted excited states of baryons are enabling the first quantitative examinations of the electromagnetic structure of low-lying baryon excitations including the $N^*(1535)$, the Roper and the $\Lambda(1405)$ on the lattice. For example, the strange-quark contribution to the magnetic moment of the $\Lambda(1405)$ indicates its structure is dominated by a $\overline{K}N$ molecular bound state. Drawing on new advances in effective field theory, the connection between lattice QCD results and experiment is established, revealing the underlying structure of baryons resonances. While the $N^*(1535)$ has a structure similar to that of ground state baryons, both the Roper and the $\Lambda(1405)$ reveal themselves to be dynamically generated resonances through coupled channel effects.