

# XVth Quark Confinement and the Hadron Spectrum



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## Understanding the nature of the Delta(1600) Resonance

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Recent lattice QCD results for the low-lying positive parity  $\Delta$  spectrum indicate that the  $2s$  excitation of the ground state  $\Delta(1232)$  lies at  $\sim 2.15$  GeV. This sits significantly above the experimentally measured mass of the first positive parity excitation, the  $\Delta(1600)$ . Using Hamiltonian Effective Field Theory (HEFT), the  $1s$  and  $2s$  states are represented by single-particle bare basis states, mixing through  $\pi N$  and  $\pi \Delta$  scattering channels. Constraining this Hamiltonian to  $p$ -wave  $\pi N$  scattering data, we extract the finite-volume energy spectrum for this system at unphysical pion masses. This allows for comparison with recent lattice QCD results, providing insight into the structure of lattice QCD eigenstates through the eigenvectors of the Hamiltonian. This method indicates that the eigenstate associated with the  $\Delta(1600)$  is dominated by  $\pi N$  and  $\pi \Delta$  rescattering contributions, rather than the dressing of a three-quark-like core as previously considered in literature.

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