# PR12-16-010A: *A Search for Hybrid Baryons in Hall B with CLAS12*

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This proposal seeks to discover hybrid baryons - resonances with conventional baryon quantum numbers but which feature an excitation of the gluonic field. The possible existence of such states has been discussed in a number of models, and recent support comes from lattice QCD calculations that suggest such states could appear in an energy region that does not feature conventional excitations.

The experimental approach is to collect electroproduction data for a number of final states and hope to observe signals compatible with new nucleon resonances in the mass region suggested by a phenomenology based upon lattice QCD calculations. A technique to identify these states as hybrid baryons rather than more conventional states is proposed based upon them having characteristic Qsq dependence in their transition form-factors.

Ultimately the intuition that hybrid baryons should have qualitatively different transition form-factors from conventional baryons will need to be investigated in a systematic approach to QCD, as will their hadronic decay properties. These are challenges for theorists and need not slow down the collection of relevant data.

The proposal does contain some mixed messages regarding the use of the form-factors for identification. According to the discussion on page 18, low values of $Q^2$ are preferred to study hybrid baryons, but on page 23 it is argued that form-factors at small $Q^2$ measure the meson-baryon cloud. One suspects that this uncertainty reflects the lack of a reliable systematic QCD-based approach, indeed whether the proposed separation into 'meson-baryon' versus 'quark-core' (and presumably 'quark-gluon-core' for hybrids?) can be made rigorous within QCD remains to be seen.

Some smaller queries:

page 16: The text suggests that N*(1535) is associated with $s\bar{s}$? Do the authors believe it to be hidden strangeness pentaquark?

page 19: What are 'dynamical singularities for the non-resonant amplitudes'?