A Letter of Intent to the Jefferson Lab PAC43

Search for Hybrid Baryons with CLAS12 in Hall B

Annalisa D'Angelo,[1,2] Ilaria Balossino,[12] Luca Barion,[12] Marco Battaglieri,[3] Vincento Bellini,[13] Volker Burkert,[4] Simon Capstick,[5] Daniel Carman,[4] Andrea Celentano,[3] Guisepper Ciullo,[12] Philip Cole,[6] Marco Contalbrigo,[12] Volker Credé,[5] Raffaella De Vita,[3] E. Fanchini,[3] Gleb Fedotov,[7] Alessandra Filippi,[11] Evgeny Golovach,[7] Ralf Gothe,[8] Boris S. Ishkhanov,[7,14] Evgeny L. Isupov,[7] Valeri P. Koubarovski,[4] Lucilla Lanza,[2] Paola Lenisa,[12] Francesco Mammoliti,[13] Victor Mokeev,[4,7] Aram Movsisyan,[12] Mikhail Osipenko,[3] Luciano Pappalardo,[12] Marco Ripani,[3] Allesandro Rizzo,[2] Jan Ryckebusch,[9] Iuliia Skorodumina,[8,14] Concetta Sutera,[13] Adam Szczepaniak,[10,4] Mauro Taiuti,[3] Mateo Turisini,[12] Maurizio Ungaro,[4] and Veronique Ziegler[4]

[1] *INFN, Sezione di Roma Tor Vergata, 00133 Rome, Italy*
[2] *Universita' di Roma Tor Vergata, 00133 Rome Italy*
[3] *INFN, Sezione di Genova and Dipartimento di Fisica, Universita' di Genova, 16146 Genova, Italy*
[4] *Thomas Jefferson National Accelerator Facility, Newport News, Virginia 23606, USA*
[5] *Florida State University, Tallahassee, Florida 32306, USA*
[6] *Idaho State University, Pocatello, Idaho 83209, USA*
[7] *Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, 119234 Moscow, Russia*
[8] *University of South Carolina, Columbia, South Carolina 29208, USA*
[9] *Gent University, Gent, Netherland*
[10] *Indiana University, Nuclear Theory Center, Bloomington, Indiana*
[11] *INFN, Sezione di Torino, Torino, Italy*
[12] *INFN Ferrara e Universitá di Ferrara, Italy*
[13] *INFN, Sezione di Catania, Catania, Italy*
[14] *Physics Department at Lomonosov Moscow State University, Leninskie Gory, Moscow 119991, Russia.*

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We plan to submit a proposal to an upcoming Jefferson Lab Program Advisory Committee with the aim to launch an experimental program that will utilize the CLAS12 detector system in Hall B to study the s-channel excitation of baryons with dominant gluonic admixtures (hybrid baryons). The experiment will use electron beams with energies of 6.6, 8.8, and 11 GeV impinging upon a liquid hydrogen target in the CLAS12 center. Scattered electrons will be detected in an angle range of 2.5° to 4.5° in the Forward Tagger and for angles greater than 6° in the CLAS12 Forward Detector. At the requested beam energies, the mass range up to 3.5 GeV over a Q^2 range of 0.05 to 2.5 GeV^2 will be covered. Due to the high electron rate at the very forward polar angles, additional constraints on the hadronic final state will be built into the CLAS12 trigger system to reduce the recorded event rate to a maximum of 20 kHz.

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Besides the search for hybrid baryon states, there are many open issues in our knowledge of the structure of ordinary baryon excitations, that can be addressed with data taken in parallel from the same experiment. As an example we show in Fig. **??** the electrocouplings of the $N(1680)\frac{5}{2}^+$ resonance, the strongest state in the third nucleon resonance region. With the exception of the real photon point, the data are quite sparse for $Q^2 \leq 1.8$ GeV^2 and the high statistics data expected from this project would remedy the lack of experimental information and address similar situations for other states as well. Note that the very high Q^2 part will be covered by the approved JLab experiment E12-09-003.

An even more compelling example is the $N(1675)\frac{5}{2}^-$ state, where data at $Q^2 > 1.8$ GeV^2 have been published recently by the CLAS Collaboration [20]. Figure **??** shows the measured helicity amplitudes. Low Q^2 data are very important here, as for this state the quark transitions are strongly suppressed by the Moorhouse selection rule, and therefore, any non-zero value of the electrocoupling amplitudes will directly measure the strength of the meson-baryon contributions. The main data needed are single pion production $ep \to e'\pi^+n$ and $ep \to e'\pi^0p$. These processes can be accumulated with sufficiently high event rates, even with a pre-scale factor of 10 or more on the FT, should the overall event rate be too high in this 2-prong topology.

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