



Theoretical Motivations and Empirical Evidence for Diquark Correlations in Hadrons

Organisers:

Zhaoqian Yao — Helmholtz-Zentrum Dresden-Rossendorf (HZDR)

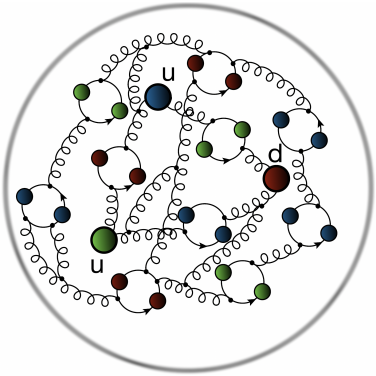
Craig Roberts — INP, Nanjing University

Bogdan Wojtsekhowski — Jefferson Lab

ECT*, Trento, Italy

19–23 October 2026

The proton as a correlated QCD system



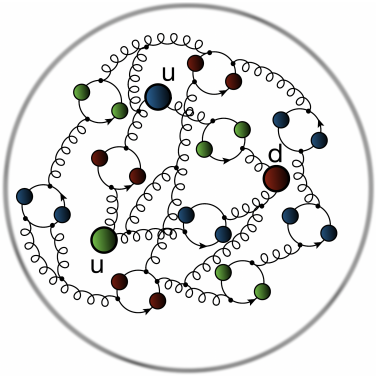
Proton

From *arXiv:2403.08088*

A complex dynamical system

Valence quarks, sea quarks and gluons

The proton as a correlated QCD system



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The workshop question

If diquark correlations are real, then where should physics best look to find, understand, and exploit them?

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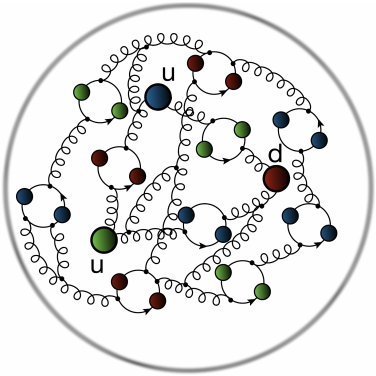

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Our shared goal

Develop a coherent, unified picture of hadron structure.

How to probe diquark correlations?

Experimental measurements

- Elastic scattering and flavour-separated electromagnetic form factors
- Spin-dependent observables and fragmentation
- Hadron spectroscopy and heavy-baryon decays

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Theoretical methods

- Lattice QCD:
  Numerical, nonperturbative QCD on a spacetime lattice
- Continuum Schwinger function methods:
  Nonperturbative continuum equations for QCD correlation functions
  Freeman Dyson and Julian Schwinger: foundational equations
  Craig Roberts: development and applications in hadron physics
- Phenomenological and effective approaches:
  QCD sum rules, effective theories, quark models and coupled channels: complementary descriptions of hadron structure and dynamics

Regular talks (45 minutes – including questions)

Theoretical motivations

- Emergence and Consequences of Diquark Correlations [Craig Roberts, Mon AM, next]

Experimental evidence

- Diquark evidence in elastic scattering processes [Bogdan Wojtsekhowski, Mon AM]

Form factors and electromagnetic structure

Experimental probes

- Nucleon resonance electro-Direct Experimental Measurement of Diquark Correlations in Baryons [Ralf Gothe, Mon PM]
- Nucleon Form Factors with BigBite [Gordon Cates, Tue AM]
- Opportunities with an Electron-Ion Collider [Tanja Horn, Wed PM]
- Some Possibilities with High Luminosity at JLab [Victor Mokeev, Thu PM]

Data analysis

- Objective analysis of extant form factor data [Daniele Binosi, Mon AM]

Form factors and electromagnetic structure

Theoretical descriptions and comparisons

- Electro-magnetic properties of excited baryons from a DCC model [Michael Doering, Mon PM]
- Light-Front Transverse Nucleon Charge and Magnetisation Densities [Zhen-Ni Xu, Tue PM]
- Large-Momentum Form Factors of the Nucleon from Lattice QCD [Sergey Syritsyn, Tue PM]
- Electromagnetic Properties of Spin-3/2 Baryons: From the Δ to Triply Heavy Ω [Zhaoqian Yao, Fri AM]

Spectroscopy and exotic hadrons

Diquarks and multiquark systems

- Probing diquarks in lattice QCD [Anthony Francis, Tue AM]
- Multiquark states with functional methods [Gernot Eichmann, Wed AM]
- Properties of tetraquark states from lattice QCD [Ying Chen, Wed AM]
- Exotic states with coupled channels [Tetsuo Hyodo, Thu AM]

Baryon structure and experimental tests

- Diquark correlation probed in heavy baryon hadronic weak decays [Qiang Zhao, Wed AM]
- Excited heavy baryons from QCD sum rules [Huaxing Chen, Thu AM]
- Study of diquark correlations via baryon spectroscopy at J-PARC [Kotaro Shirotori, Thu AM]
- Review of quark model new results [Elena Santopinto, Fri AM]

Parton structure

Distribution amplitudes, wave functions and evolution

- Diquark correlations in the proton parton distribution amplitude [Bilgai Almeida-Zamora, Wed AM]
- Diquark correlation in nucleon lightfront wave functions [Cédric Mezrag, Wed PM]
- All-orders evolution: theory and practice [José Rodríguez-Quintero, Thu PM]

Fragmentation, semi-inclusive and exclusive probes

- Probing diquark correlations using SIDIS on nuclei [William Brooks, Tue AM]
- Evidence for diquarks in proton fragmentation functions [Hui-Yu Xing, Tue AM]
- Exclusive Vector-Meson Photoproduction as a Probe of Hadron Structure [Minghui Ding, Thu AM]
- Backward DVCS in a Sullivan Process [Abigail Rodrigues Castro, Fri AM]

Short talks and discussions

Short talks (25 minutes – including questions)

Mon–Thu, (after coffee)

Theory and experiment: partonic structure, bound-state dynamics, spin and orbital angular momentum, and electromagnetic form factors.

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Discussion sessions

Mon–Thu, 17:00

Closing discussion

Fri, 11:45

Practical information

Lunch and Wednesday dinner: please sign up

- **Everyone having lunch should sign the lunch sign-up sheet.**
- **Everyone attending Wednesday's dinner should also sign the dinner sign-up sheet.**

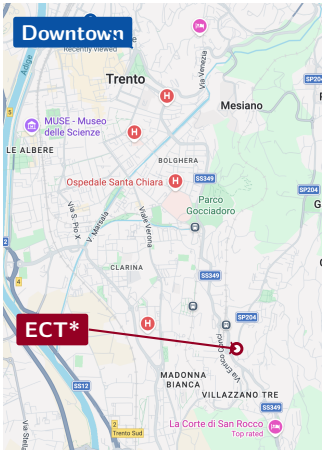
Internet access

- Connection details are included in your conference packet.
- **Eduroam works**: connect using your home-institution credentials.

Please contact

- **Susan Driessen**: driessen@ectstar.eu
- **Zhaoqian Yao**: z.yao@hzdr.de

From downtown Trento to ECT*



Bus 6 approximately every 20 min on weekdays

Get off at **Villazzano "Villa Tambosi"**.

Bus 13 an alternative connection

Check the downtown boarding stop and destination.
Get off at **Villazzano "Villa Tambosi"**.

Train: From Trento railway station to Villazzano station

Valsugana line, towards Pergine / Borgo / Bassano.
Then walk approximately 450 m to ECT*.

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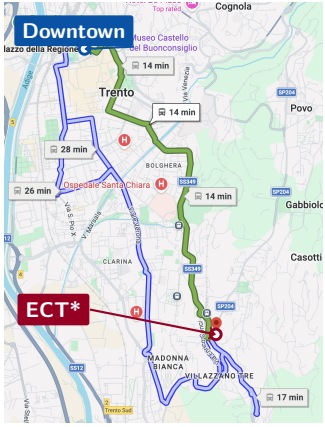


Bus 6

Do NOT board bus 6 directly in front of the station:
that bus goes in the wrong direction.
Get off at **“Villa Tambosi”**.

Bus 6/: San Rocco detour

Before “Villa Tambosi”, the bus makes a short detour uphill through San Rocco. You can get off at **“Villazzano Stazione FS”**.

Workshop dinner



Orso Grigio

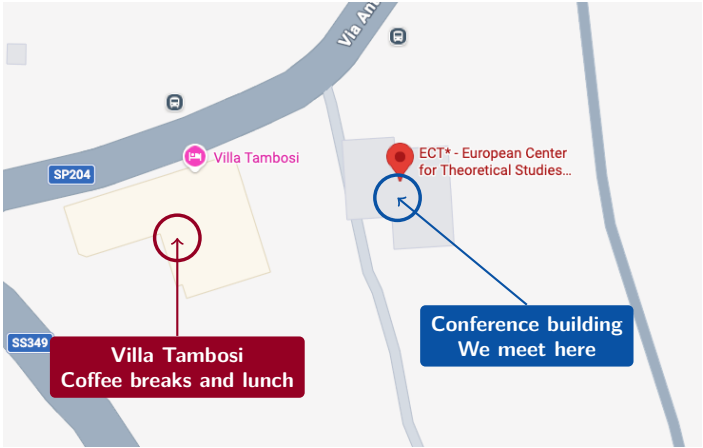
Wednesday, 21 October 2026

20:00

Via degli Orti 19, Trento

orso-grigio.it

Coffee breaks and lunch



Scientific sessions

Conference building (the red map pin). **Coffee breaks and lunch**

Villa Tambosi, the building next door.

Opening the scientific programme

Thank you to our hosts, organisers, speakers and all participants.

First scientific talk

Craig Roberts

Emergence and Consequences of Diquark Correlations