



N4 – QCDnet

Hadron physics with light and heavy quarks

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SUCCESSSES of HadronTH (I3HP-N5)

Quotes from the report of the SAC:

- It covered studies of a broad set of hadron properties . . . thus contributing to the unity of the field
- It induced collaborations between lattice and non-lattice theorists needed . . .
- It was extremely useful in relating theoretical studies to experimental activities at Transnational Access facilities
- It strengthened European collaborations in the field
- It produced a large number of publications and conference contributions

⇒ The Network will involve with significant new objectives in FP7

OBJECTIVES

- Strong interactions at low & intermediate energies: **strong QCD**
from light to heavy quark systems, from strong to perturbative QCD
- Manifestation of QCD in hadrons and systems made thereof:
symmetry breaking and restoration, isospin violation, flavor physics,
few-nucleon and hypernuclear physics, medium modifications, ...
- Provide improved theoretical tools:
effective field theories, chiral extrapolations, dispersive techniques, ...
- Detailed analysis of experimental results: Phenomenology & Exp. proposals
- New facilities = new opportunities:
FAIR (Darmstadt), J-PARC (Tokai), JLAB12 (Newport News), ...

⇒ **QCDnet: Hadron physics with light and heavy quarks**

NETWORK PROJECTS

- 4 main research areas w/ specific tasks

P1 Hadron dynamics with light quarks

Chiral symmetry and hadron properties, structure and dynamics of mesons, structure and dynamics of baryons, hadronic molecules and exotic states, quark model studies of hadrons, hadron-hadron interactions, GPDs, . . .

P2 Hadron dynamics with heavy quarks

Strong interaction corrections to weak decays, charm quark physics, bottom quark physics, final-state interactions and light quark dynamics, from strong to perturbative QCD

P3 Hadrons in nuclei

Precision calculations for few-nucleon systems, hypernuclear physics, hadrons with charm quarks, medium modifications of hadrons in nuclei, meson production off nuclei, hadronic atoms and fundamental interactions

P4 EFT methods for continuum and discrete QCD

combining chiral perturbation theory with dispersion relations, unitary extensions of CHPT, chiral extrapolations for hadron properties and interactions, finite volume effects and hadron resonances, RG methods in hadronic systems

NETWORK PROJECTS continued

- Specific tasks of the various nodes (P1, P2):

1) **Tasks in P1: Hadron dynamics with light quarks**

- A Chiral symmetry and hadron properties: **BN, CO, TÜ, MA, VA, DA, LU, GZ, BO, MN, BE, MS, MZ, AN**
- B Structure and dynamics of mesons: **SA, LU, BE, MS, MO, AN**
- C Structure and dynamics of baryons: **GZ, BO, MN, LI, PA, AN**
- D Hadronic molecules and exotic states: **JÜ, MÜ, VA, DA**
- E Quark model studies of hadron properties: **PV, TÜ, MA, GZ, HE, LI**
- F Hadron-hadron interactions: **GZ, JÜ, CR, MU, BA, HE, PA**
- G Structure functions and GPDs: **PV, TÜ, BO, MO**

2) **Tasks in P2: Hadron dynamics with heavy quarks**

- A Strong interaction corrections to weak decays: **JÜ, MS**
- B Charm quark physics: spectroscopy and decays: **CO, GR, TÜ, MÜ, DA, GZ, PA**
- C Bottom quark physics: spectroscopy and decays: **SA, CO, BE, MZ**
- D Final-state interactions and light quark dynamics: **SA, CO, MU, DA, BN**
- E From strong to perturbative QCD: **MU**

NETWORK PROJECTS continued

- Specific tasks of the various nodes (P3, P4):

3) **Tasks in P3: Hadrons in nuclei**

- A Precision calculations in few-nucleon systems: **JÜ, CR, MN, LI**
- B Hypernuclear physics: **JÜ, GR, BA**
- C Hadrons with charm quarks: **VA, GR, BA, DA**
- D Medium modifications of hadrons in nuclei: **VA, GI**
- E Meson production off nuclei: **VA, GI, MZ**

4) **Tasks in P4: EFT methods for continuum and discrete QCD**

- A Combining chiral perturbation theory and dispersion relations: **PV, MA, MU, HE, BE, PA**
- B Unitary extensions of CHPT and resonances in large N_c : **MA, MU, MS**
- C Chiral extrapolations of hadron properties: **BN, MA, MÜ, LU, BO**
- D Chiral extrapolations for hadron interactions: **BA**
- E Finite volume effects and hadron resonances: **BN, BE, MS**
- F Renormalization group methods in hadronic systems: **CO, MN, MZ**
- G Heavy quark effective field theories: **MÜ, BE, MZ**

INVOLVED LABORATORIES & SCIENTISTS

- 27 nodes from 13 countries

U. Bonn (BN), TU München (MÜ), U. Mainz (MZ), U. Bochum (BO), U. Tübingen (TÜ),
U. Gießen (GI), FZ Jülich (JÜ), GSI Darmstadt (DA), U. Graz (GZ), U. Valencia (VA),
U. Barcelona (BA), U. Granada (GA), U. Madrid (MA), U. Murcia (MU), U. Salamanca (SA),
CPT Marseille (MS), U. Paris-Sud (PA), U. Pavia (PV) , U. Bern (BE) , U. Manchester (MN),
U. Cracow (CR), U. Lund (LU), HIP Helsinki (HE), IST Lisbon (LI), U. Coimbra (CO),
ITEP Moscow (MO), ODTU Ankara (AN) (associated nodes)

- 99 permanent researchers, 45 post-doc, 64 students → **85.9 FTE**
- Strong link to lattice QCD activities, all TNAs and many JRAs

⇒ We are well prepared to contribute significantly within FP 7

REQUESTED FUNDING

Detailed budget

4 2-year post-docs (for each project area)	440 k€
2 large workshops	50 k€
4 topical workshops	60 k€
Exchange visits between the nodes	300 k€

- Will have 5 contractors (BN, JÜ, MZ, VA, HE)

⇒ The costs not including indirect costs amount to **850 k€**

⇒ The total request from the EC is **1020 k€** including 20% university overhead

