

Objectives / main research areas:

- **Understand the spectrum, properties, and inner structure of hadrons.** (Mesons, Baryons – light and heavy)
- **Clarify the nature of exotic hadrons and what they tell us about QCD.**
- **Operate the new experiment INSIGHT @ ELSA and investigate the non-strange and strange baryon spectrum, search for multi-quark and molecular states.**
- **Understand occurrence of two-pole structures in meson and baryon sectors.**
- **Investigate final-state interactions in hadronic decays.**

⇔ From the light to the heavy quarks

⇔ Connecting to the other RA's, especially RA2

Projects that will receive funding in the first round

- 1) Ulf: **Ab initio calculation of hadronic three-particle decays in QCD** - with Carsten 1 PostDoc (33 mo)
- 2) Stefan+Tom Luu: **Lattice Quantum Chromodynamics study of exotic hadrons** - with C.H. 1 PhD (27 mo)
- 3) Bastian: **B-decays with multi-hadron final states** - with Thomas, C.H. (= funded from different source)
- 4) Christoph: **(a) Spectroscopic analyses of exotic states and their spin and flavor partners: data driven insights and implications for CP violation** 1 PostDoc (33 mo)
(b) Light-quark mass dependence of doubly heavy tetraquark
(c) From LHCb to Lattice QCD: an extended chiral EFT approach to P_c Pentaquarks and $\Lambda_c \bar{D}^{(*)}$ -dynamics
- 7) Bastian: **Conformal maps for hadronic form factors** 1 PhD (12 mo)
- 8) Peter: **P_s pentaquark-search at INSIGHT**
- 9) Tom Jude: **Study of exotic states with INSIGHT**
- 10) Ulrike for INSIGHT et al.: **Software developments for INSIGHT**
- 11) Bernhard, Peter: **Light and strange exotic mesons – Advanced fitting methods** 1 PhD (30 mo)
- 12) Ulrike, Sebastian, Johannes, Deborah: **PWA to understand the light (u,d) and (u,d,s) baryon sector / Combining light baryon spectroscopy data (from ELSA) with LHCb-data in a PWA** 2/3 PostDoc (36 mo) U
1 PhD (12 mo) D; 1 PhD (30 mo) S

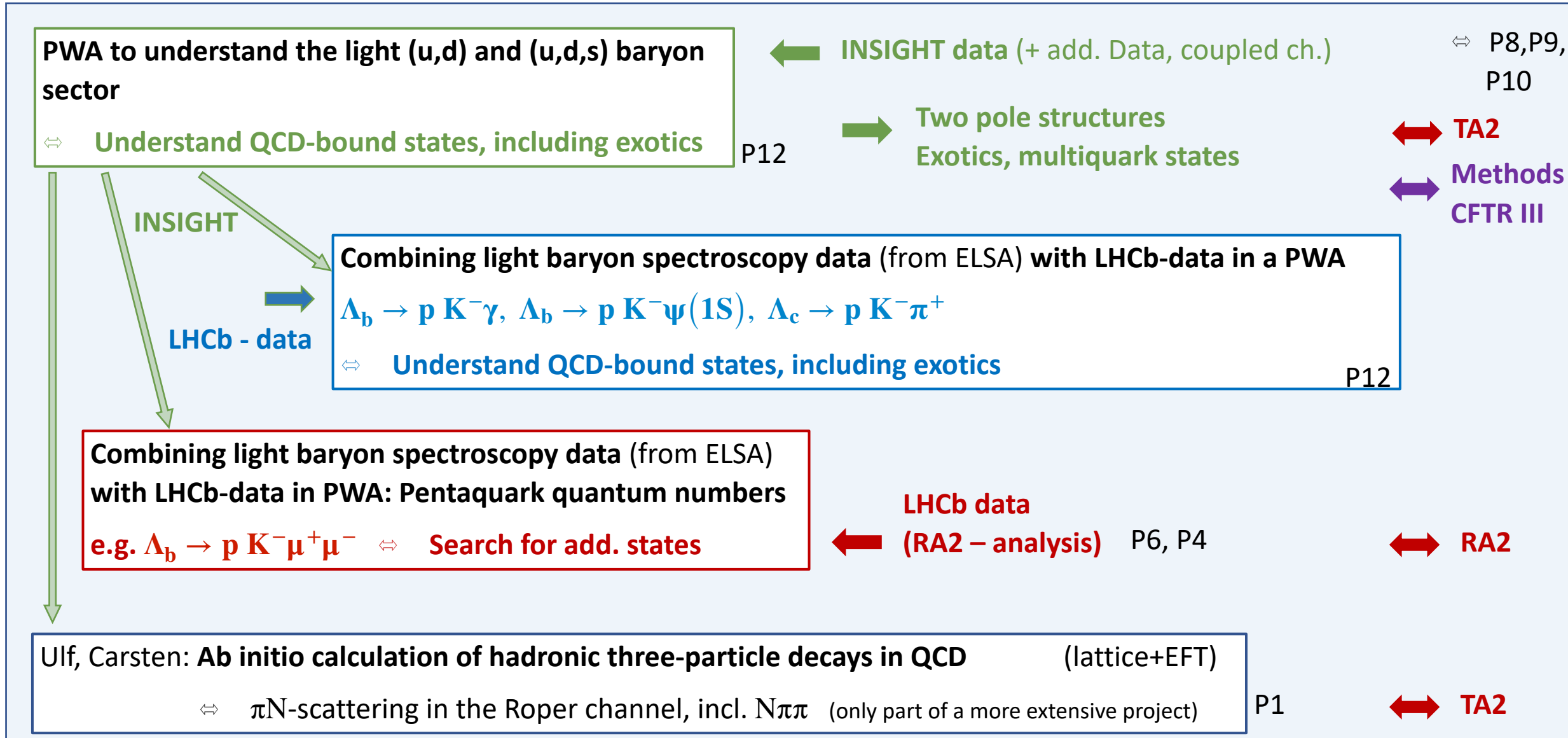


discussed tomorrow

RA1 „Bound states of light and heavy quarks“

Ulrike, Sebastian, Johannes, Deborah, Ulf, Carsten, Bastian, C.H.:

CFRT I



Bernhard, Peter, Bastian, Thomas, Ulf, Carsten, C.H.:

CFRT II

Bernhard, Peter: **Light and strange exotic mesons – Advanced fitting methods**

P11

↔ TA2

- **Tool developments:** unitary fit models, coupled channel analysis, inclusion of rescattering effects, extraction of branching ratios

← From theory groups:
unitary constraints,
analyticity

↔ Methods also for
CFTR I - PWA baryons

- ↔ analysis of COMPASS data / later AMBER (2031) data
 - $\pi_1(1600) \rightarrow \eta\pi, \eta'\pi$
 - development of unitary models for 3 particle states
 - analysis of $3\pi, K\pi\pi$

↔ **Understand QCD-bound states, incl. exotics**

Bastian, Thomas, C.H.:

- ↔ **with RA2:** Excited meson spectrum for $B \rightarrow 3h$,
 - final state interactions and role of D-meson loops and exotics
 - understand decay spectra, Dalitzplots
 - amplitudes, strong phases ↔ **CP-violation**

P3, P4, P7

↔ RA2

Ulf, Carsten: **Ab initio calculation of hadronic three-particle decays in QCD**

P1

- ↔ excited kaons from the lattice (only part of a more extensive project)

↔ TA2

Sebastian, Deborah, Tom Luu, Stefan, C.H.:

CFRT III

Chiral EFT + LHCb-Data + lattice $\Leftrightarrow$ Exotics

$\longleftrightarrow$ TA2

C.H.: **From LHCb to Lattice QCD: an extended chiral EFT approach to P_c Pentaquarks and $\Lambda_c \bar{D}^{(*)}$ -dynamics** P4

- Include $\Lambda_c \bar{D}^{(*)}$ - LHCb –data into pentaquark analysis
- Extend analysis to finite volume $\Rightarrow$ analysis of emerging lattice data
- Strange sector of hidden charm pentaquarks

$\longleftarrow$ LHCb data

$$\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{D}^{(*)} K^-$$

$$\Lambda_b^0 \rightarrow \Sigma_c^+ \bar{D}^{(*)} K^-$$

Sebastian

$\longleftarrow$

JüBo – work on

$\Lambda_c \bar{D}^{(*)} - \Sigma_c^{(*)} \bar{D}^{(*)}$ interact.
Deborah

C.H.: **Light-quark mass dependence of doubly heavy tetraquark**

P4

- Analysis of lattice results for $T_{cc}^{(\prime)}$ and T_{bc} states, predictions for spin partners

Stefan, Tom Luu: **Lattice Quantum Chromodynamics study of exotic hadrons**

P2

- Investigation of the structure of exotic charmed hadrons ($T_{cs}(2900)0^+$, $T_{cs}(2900)1^+$, $T_{cc}(3875)$, and $T_{c\bar{s}}(2900)^{++}$)
- lattice QCD simulations for $\bar{c}\bar{s}ud$, $c\bar{s}u\bar{d}$, $ccu\bar{d}$, and $c\bar{c}u\bar{d}$ with $N_f = 2 + 1$ dynamical quarks
- Extraction of scattering information and pole positions

Summary:

- **3 Cross-Functional Research Teams (CFTR) of comparable size**
- **Still have to work out better connections to other RAs**
 - ⇒ so far only connections to RA2 clear ...
 - ⇒ **additional topics?** (without project descriptions handed in so far)
- **We need good names for the CFTRs**

Thanks a lot for your attention!