HK 19: Hadron Structure and Spectroscopy III

Time: Monday 16:00–17:45 Location: HK-H8

Group Report HK 19.1 Mon 16:00 HK-H8

Coupled Channel Partial Waves Analysis with PAWIAN — •Meike Küssner[1], Bertram Kopf[1], Malte Albrecht[1], Fritz-Herbert Heinsius[1], Helmut Koch[1], Marc Pelizäus[1], Xiaoshuai Qin[1], Matthias Steinke[1], Ulrich Wiedner[1], and Lianjin Wu[2] — [1]Ruhr-Universität Bochum, Germany — [2]Shandong University, Qingdao, China

The light meson regime still holds open questions that can only be answered using sophisticated analysis strategies to describe the data. Coupled channel partial wave analyses offer unique possibilities to disentangle the different states in the highly populated spectrum of light mesons and to overcome challenges such as interfering and overlapping resonances that decay into multiple channels and occur close to kinematical thresholds.

This also requires the use of performant software that incorporates sophisticated dynamical models taking into account unitarity and analyticity constraints. The software package PAWIAN offers such possibilities and proved its capabilities in recent coupled channel analyses. The talk will discuss recent results of coupled channel analyses performed with data stemming from different production mechanisms like $\bar{p}p$ annihilation, $\pi^- p$ scattering, radiative J/ψ decays and two-photon production as well as $\pi\pi$ scattering and discuss future objectives.

Supported by DFG CRC110 and FOR 2359

HK 19.2 Mon 16:30 HK-H8

Amplitude analysis of the decays $B_S \to \psi(2S)K^+K^-$ and $B_S \to \psi(2S)\pi^+\pi^-$ — •Piet Nogga — Rheinische Friedrich-Wilhelms Universität Bonn

We present $\psi(2S)K^+K^-$ and $\psi(2S)\pi^+\pi^-$ final state data originating from B_S mesons recorded during Run I and Run II at the LHCb experiment corresponding to an integrated luminosity of 1,2 and 6 fb^{-1} at $\sqrt{s} = 7, 8$ and 13 TeV, respectively, with the goal of investigating the spectrum of scalar mesons. These are particularly interesting as they may contain possible glueball contributions, a discussion which was recently rekindled by a BESIII analysis regarding radiative charmonium decays.

The unambiguous extraction of resonance parameters requires sophisticated amplitude models and techniques for the simultaneous analysis of both channels.

This talk will present a preliminary selection of these final states and discuss the coupled channel analysis.

HK 19.3 Mon 16:45 HK-H8

A truncated partial wave analysis using bayesian inference — •Jean Noël for the CBELSA/TAPS-Collaboration — HISKP, Rheinische Friedrich-Wilhelms Universität Bonn.

Following the description of the Standard Model of particle physics, more specifically quantum chromodynamics (QCD), so called hadrons are bound states of quarks and gluons. A difficulty in investigating these fundamental particles arises from being unable to observe them in isolation due to confinement.

One approach for investigating the formation of hadrons is the photoproduction of mesons.
The focus will lie on the reaction $p + \gamma \to p + \pi^0$. By employing a truncated partial wave analysis (TPWA) the approach can be kept model independent. A fully bayesian investigation will be employed and the advantages of extracting the partial waves (up to an overall phase) with this method will be discussed.

Preliminary results obtained from this approach will be shown.

HK 19.4 Mon 17:00 HK-H8

Meson Spectrum from Functional Methods beyond Rainbow-Ladder — •Stephan Hagel[1,2] and Christian S. Fischer[1,2] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität Gießen, 35392 Gießen, Germany — [2]Helmholtz Forschungsakademie Hessen für FAIR (HFHF), GSI-Helmholtzzentrum für Schwerionenforschung, Campus Gießen, 35392 Gießen, Germany

A novel approach to construct an expression for the quark self-energy from a Bethe-Salpeter kernel is presented. It can be shown that this approach satisfies the axialvector Ward-Takahashi identity. This approach is used to calculate the quark propagator and solve the corresponding Bethe-Salpeter equation. Furthermore, it is investigated, how different tensor structures in the quark-gluon-vertex effect the light meson spectrum.

HK 19.5 Mon 17:15 HK-H8

Multidimensional density estimation using Normalizing Flows — •Ellinor Eckstein — University of Bonn, Bonn, Germany

The investigation of multi-body hadronic decays of beauty and charm hadrons requires detailed estimates of efficiencies and background distributions in multidimensional phase space.

A fairly new approach for model independent density estimation are Normalizing Flows, a Machine Learning technique, which gained popularity in recent years. They provide a method to construct flexible probability density distributions by applying a series of trainable transformations on a simple base distribution. A special feature of these distributions is their invertibility. Consequently, the entire Normalizing Flow is invertible and, thus, a very transparent tool for parametrisations. Due to their straightforward structure NFs are easily expandable into multiple dimensions making them attractive for efficiency or background estimation. This talk gives a brief introduction to Normalizing Flows and demonstrates its performance on LHCb data.

HK 19.6 Mon 17:30 HK-H8

4-quark states from functional methods — •Joshua Hoffer[1,2] and Christian S. Fischer[1,2] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität Gießen, 35392 Gießen, Germany — [2]Helmholtz Forschungsakademie Hessen für FAIR (HFHF), GSI-Helmholtzzentrum für Schwerionenforschung, Campus Gießen, 35392 Gießen, Germany

Since the discovery of tetraquarks, there has been a lot of excitement around this topic from the theoretical as well as the experimental side. To study the poperties of these 4-quark states we use a functional framework which combines (truncated) Dyson-Schwinger and Bethe-Salpeter equations in Landau gauge. This approach allows us to extract qualitative results for mass spectra, decay widths and wavefunctions of tetraquark candidates. Furthermore, we can investigate the possible internal structure of such states. We report on recent developments and results using this functional framework and give an overview about the current status as well as future developments.