HK 28: Hadron Structure and Spectroscopy IV

Zeit: Mittwoch 16:45–19:00 Raum: F 5

Gruppenbericht HK 28.1 Mi 16:45 F 5

recent progress of charmonium spectroscopy at BESIII — •Zhiqing Liu for the BESIII-Collaboration — Joh-Joachim-Becher-Weg 45

After the discovery of the Zc(3900) by BESIII, we believe that charmonium-like states are good candidates for potential four-quark states. However, the exact structure of four-quark states are still a puzzle presently, and more detailed experimental study about them are urgently needed. In this talk, I will reported the recent progress about charmonium spectroscopy at the BESIII experiment, including the spin-parity measurement of Zc(3900), and the precise measurement of vector Y-states by using the scan data.

HK 28.2 Mi 17:15 F 5

Effects of meson loops on a spectrum of quark states — •Inka Hammer[1], Christoph Hanhart[1], and Alexey V. Nefediev[2] — [1]Forschungszentrum Jülich, Institut für Kernphysik, Jülich, Germany — [2]Institute for Theoretical and Experimental Physics, Moscow, Russia

In recent years, many so called "XYZ" states have been discovered, which were not anticipated from conventional quark models. In their simplest form, quark models describe the confining interaction between effective constituent quarks which leads to the formation of hadrons as bound states. However it has been argued for a long time that when building quark models with coupled channels, unitarization cannot be neglected. In addition to introducing an imaginary part to the masses and resulting in considerable mass shifts, it has been found to have many interesting and unexpected consequences. To come to an understanding of the heavy quarkonium spectrum and the nature of the "XYZ" mesons, it is essential to systematically investigate how the inclusion of meson loops effects a quark spectrum.

As a step in this direction, we study simple unitarized models. We demonstrate that in general quark states do not tend to get very broad if their coupling to the continuum increases, but instead they decouple from the latter in the large coupling limit. However a few of them behave very differently and demonstrate a kind of collectivity. While the actual calculations are done within particular, very simplified models, we argue that the findings might well be general.

HK 28.3 Mi 17:30 F 5

Study of χ_c Decays into $\eta'\,\pi^0\pi^0$ at BES III — •Maximilian Hegenbarth for the BESIII-Collaboration — Ruhr-Universität Bochum, Institut für Experimentalphysik I, 44780 Bochum

The BESIII experiment, which is located at the symmetric e^+e^- collider BEPCII in Beijing, has recorded a data sample corresponding to about 448×10^6 $\psi(2S)$ events. In the radiative transitions $\psi(2S) \to \gamma\,\chi_{cJ}$ the charmonium P-wave states are copiously produced. Their decays into light hadrons provide a clean source in search for exotic hadrons. A spin-exotic 1^{+-} state decaying into $\pi^+\eta$ has recently been reported by the CLEOc collaboration in the decay $\chi_{c1} \to \eta'\,\pi^+\pi^-$. To search for neutral partner states we study the decay $\chi_{cJ} \to \eta'\,\pi^0\pi^0$. Preliminary results of this study will be presented.

This work is supported by the DFG (FOR 2359)

HK 28.4 Mi 17:45 F 5

Study of χ_{cJ} Decays into $\eta\pi^0\pi^0$ at BESIII — •Christian Mertes for the BESIII-Collaboration — Ruhr-Universität Bochum, Institut für Experimentalphysik I

The BESIII experiment located at the symmetric electron-positron ring BEPCII in Beijing has recorded large data samples at center of mass energies corresponding to the $\psi(2S)$ charmonium resonance and other energies in the tau-charm mass range. In the radiative transitions $\psi(2S) \to \gamma\chi_{cJ}$ the charmonium P wave states are copiously produced. Their decays into light hadrons provide a clean source in search for exotic hadrons. Based on a data sample corresponding to about $448 \cdot 10^6$ $\psi(2S)$ events, the decay $\chi_{cJ} \to \eta\pi^0\pi^0$ is studied. Preliminary results of this study will be presented.

Supported by the DFG (FOR 2359)

HK 28.5 Mi 18:00 F 5

Description of the $X(3872)$ using a Galilean-invariant EFT — •Wael Elkamhawy, Maximilian Jansen, and Hans-Werner Hammer — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany

The proximity of the $\bar{D}^0 D^{*0}$ threshold to the mass of the $X(3872)$ suggests the interpretation of the $X(3872)$ as a hadronic molecule of neutral $D^{(*)}$ mesons. In this molecular picture, the $X(3872)$ is either a loosely bound state or a shallow resonance. The corresponding energy is small compared to the energy scale set by charged $D^{(*)}$ mesons. Exploiting this separation of scales, we construct a low-energy effective field theory for neutral charm mesons and pions exhibiting exact Galilean invariance. We discuss the implications of exact Galilean invariance on the dynamics of the $X(3872)$. This theory provides a systematically improvable description of the $X(3872)$. It is used to calculate the scattering length to next-to-leading order. Moreover, the dependence of the pole energy on the light quark masses is derived. This dependence can be used to extrapolate, e.g., binding energies calculated on the lattice at unphysical light quark masses to the physical value.

∗ This work has been supported by the DFG through Grant SFB 1245.

HK 28.6 Mi 18:15 F 5

Dispersive approach to the triangle diagram in the decay of the $a_1(1260)$ resonance — •Mathias Wagner, Mikhail Mikhasenko, and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, 53115 Bonn, Germany

Recently a resonance-like signal was observed by the COMPASS experiment in the $J^{PC} = 1^{++}$ partial wave decaying to $f_0(980)\pi$, the $a_1(1420)$. One possible explanation of this signal is a triangle singularity located close to the physical axis, which is produced when the decay of the $a_1(1260)$ into K^*K is kinematically allowed.

In my talk I am going to present a dispersive approach to calculate the amplitude of the reaction $a_1(1260) \to f_0(980) + \pi$ via a triangle diagram. First the general procedure how to reconstruct the full amplitude using a dispersion relation will be explained. This requires the calculation of the discontinuity of the corresponding matrix element, which can be done by applying the Cutkosky cutting rules.

The result will be compared to calculations employing Feynman rules for hadronic processes.

In the end a fit of this theoretical result to the COMPASS data of 3π production will be presented.

Supported by BMBF.

HK 28.7 Mi 18:30 F 5

Isoscalar Single Pion Production in the Energy Region of Roper and d*(2380) Resonances — •Tatiana Skorodko[1], Mikhail Bashkanov[2], and Heinz Clement[1] for the WASA-at-COSY-Collaboration — [1]Physikalisches Institut, Uni Tübingen — [2]School of Physics and Astronomy, University of Edinburgh, UK

The isoscalar and isovector parts of the single pion production in NN collisions provide important information about the role of isoscalar and isovector resonance excitations in the course of the reaction process.

Wheareas the isovector pion production is reasonably well known from threshold up to several GeV, the isoscalar pion production has been determined experimentally so far only for beam energies below 1 GeV.

In order to obtain information about the isoscalar strength above 1 GeV, WASA data for the reactions $pp \to pp\pi^0$ and $pn \to pp\pi^-$ at $T_p = 1.2$ GeV have been analyzed. Since these reactions were taken in the quasifree mode by use of a deuterium target, the beam energy region of 1.0 - 1.3 GeV is covered, which is just the region of the Roper $N(1440)$ baryon resonance and of the $d^*(2380)$ dibaryon resonance. In the isoscalar $N\pi$-invariant mass spectrum we observe a pronounced, isolated signal from the Roper resonance. We find no evidence for a decay $d^*(2380) \to NN\pi$, hence only an upper limit is given.

*supported by DFG (CL 214/3-1 and 3-2) and STFC (ST/L00478X/1)

HK 28.8 Mi 18:45 F 5

Coherent production of pion pairs in the reaction $pd \to pd\pi\pi$ with the intermediate two-baryon-resonance excitation — Vladimir Komarov[1], Tatyana Azaryan[1], Sergey Dymov[1,2], and

•Dmitry Tsirkov[1] — [1]Laboratory of Nuclear Problems, Joint Institute for Nuclear Research, RU-141980 Dubna, Russia — [2]Institut für Kernphysik and Jülich Centre for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany

The reaction $pd \to pd + X$ was studied at 0.8–2.0 GeV energies with the ANKE setup at the COSY storage ring. The proton-deuteron pairs emerging with high momenta 0.6–1.8 GeV/c were detected at small angles with respect to the proton beam. Distribution over the reaction missing mass M_x reveals an enhancement near the threshold of the pion pair production specific for the so-called ABC effect. The invariant mass of the $d\pi\pi$ system in this enhancement region exhibits a resonance-like peak at $M_{d\pi\pi} = 2.37$ GeV/c^2 with the width $\Gamma \approx 0.10$ GeV/c^2, corresponding to the position of the d'(2370) two-baryon resonance. A possible interpretation of these features is discussed.