Handy Book
Light Cone 2010

The structure of the Light Cone 2010 will be divided into the following thematic session:

1) Light Front Field Theory and other non perturbative approaches
Convener: J. P. Vary

Subsection: 1a – Monday 14 from 9:00 to 11:00
Subsection: 1b – Monday 14 from 15:00 to 16:15
Subsection: 1c – Monday 14 from 16:45 to 18:00

2) Relativistic Nuclear and Hadron Structure
Convener: G. Salmè

Subsection: 2a – Monday 14 from 11:30 to 13:00
Subsection: 2b – Monday 14 from 15:00 to 16:15
Subsection: 2c – Monday 14 from 16:45 to 18:00

3) Non perturbative methods and renormalization theory
Convener: D. Binosi

Subsection: 3a – Tuesday 15 from 9:00 to 11:00
Subsection: 3b – Tuesday 15 from 15:00 to 16:55

4) **AdS/CFT overview and applications to strongly interacting systems**
Convener: A. Pomarol

Subsection: 4a – Tuesday 15 from 11:30 to 13:00
Subsection: 4b – Tuesday 15 from 16:25 to 18:15

5) Recent Results in Perturbative QCD
Convener: N. Glover

Subsection: 5a – Wedneday 16 from 9:00 to 10:30
Subsection: 5b – Thursday 17 from 17:35 to 18:25

6) Lattice and Hamiltonian QCD
Convener: Ph. Haegler

Subsection: 6a – Wedneday 16 from 11:00 to 13:10

7) Relativistic Heavy Ion physics and Quark Gluon Plasma
Convener: *G. Martinez*

Subsection: 7a – Thursday 17 from 9:00 to 11:10
Subsection: 7b – Thursday 17 from 15:00 to 16:40
Subsection: 7c – Thursday 17 from 17:10 to 17:35

8) Generalized Parton Distributions, Deeply Virtual Compton Scattering and TMDs
Convener: M. Burkardt

Subsection: 8a – Thursday 17 from 11:40 to 13:10
Subsection: 8b – Thursday 17 from 15:00 to 16:40
Subsection: 8c – Thursday 17 from 17:10 to 18:25

9) **The pion transition form factor and the BaBar data**
Convener: M. V. Polyakov

Subsection: 9a – Friday 18 from 9:00 to 10:30
Subsection: 9b – Friday 18 from 11:00 to 12:15

Speakers

1. I. Anikin, BLTP, JINR, Russia **–Section 8b**
2. N. Armesto, Universidad de Santiago de Compostela, Spain **–Section 7b**
3. B. Bakker, Vrije Universiteit, Netherland **–Section 2b**
4. D. Binosi, ECT*, Italy **–Section 3a**
5. S. Brodsky, SLAC, USA **EPJA Special Lecture**
6. W. Broniowski, Jan Kochanowski University and IFJ PAN, Poland **–Section 9b**
7. M. Burkardt, New Mexico State University, USA **-Section 8a**
8. O.Catà, IFIC & Universitat de València, Spain **–Section 4b**
9. S. Chabysheva, University of Minnesota-Duluth, USA **–Section 1c**
10. Z. Conesa del Valle, IPHC, UdS, France **–Section 7c**
11. A. Courtoy , INFN-Pavia, Italy **--Section 8b**
12. L. Cunqueiro, IPN Orsay, France **–Section 7b**
13. H. Dahiya, National Institute of Technology, India **-Section 8b**
14. B. Desplanques, LPSC, France **–Section 2b**
15. A. Dorokhov, Joint Instutute for Nuclear Research, Russia **--Section 9a**
16. M. Dubrovin, University of Cincinnati, USA **--Section 9a**
17. D. Dudal, Ghent University, Belgium **–Section 3a**
18. D. d'Enterria, ICREA, Univ. Barcelona, Spain **--Section 7a**
19. T. Frederico, ITA, Brazil **–Section 1b**
20. S. Glazek, University of Warsaw, Poland **-- Section 1a**
21. N. Glover, IPPP Durham, United Kingdom **–Section 5a**
22. M. González-Alonso, IFIC, Spain **– Section 5b**
23. P. Grange, Universite de Montpellier-CNRS, France **–Section 3b**
24. Ph. Haegler, TU Muenchen, Germany **–Section 6a**
25. J. Hiller, University of Minnesota-Duluth, USA **–Section 1c**
26. H. Honkanen, Iowa State University, USA **–Section 1a**
27. A. Ilderton, Umea University, Sweden **–Section 1b**
28. A. Illarionov, Universitá di Trento, Italy **–Section 5a**
29. Chueng-Ryong Ji, North Carolina State University, USA **-Section 8b**
30. V. Karmanov, Lebedev Physical Institute, Russia **–Section 2b**
31. D. Kharzeev, BNL, USA **-Section 7a**
32. A. Koshelkin, Moscow Institute for Physics and Engineering, Russia **–Section 7b**
33. D. S. Kulshreshtha, University, of Delhi, India **–Section 1b**
34. U. kulshreshtha, University, of Delhi, India **– Section 1c**
35. G. P. Lepage, Cornell University, USA **– Section 6a**
36. C. Lorcé, Mainz University, Germany **--Section 8c**
37. V. Lyubovitskij, Tuebingen University, Germany **–Section 4a**
38. G. Martinez, Subatech, France **–Section 7a**
39. L. Martinovic, BLTP JIN, Russia **–Section 3b**
40. V. Mathieu, University of Valencia, Spain **–Section 2c**
41. J.-F. Mathiot, Université Blaise Pascal, France **– Section 1a**
42. J. P. B. C. De Melo, LFTC – UNICSUL, Brazil **--Section 9b**
43. A. Mukherjee, IIT Bombay, India **--Section 8c**
44. B. Mutet, LPTA, Montpellier, France **–Section 3b**

45. R. Pérez Ramos, Universidad de Valencia, Spain --Section 5b
46. P. Petreczky, BNL, USA –Section 7b
47. H. J. Pirner, University of Heidelberg, Germany –Section 6a
48. W. Plessas, University of Graz, Austria –Section 2c
49. M. Polyakov, Ruhr-University Bochum, Germany –Section 9a
50. W. Polyzou, University of Iowa, USA –Section 2a
51. A. Pomarol, IFAE & UAB, Barcelona, Spain –Section 4a
52. G. Rodrigo, IFIC, Spain –Section 5a
53. J. Rodriguez-Quintero, Universidad de Huelva, Spain –Section 3a
54. E. Ruiz Arriola, Universidad de Granada, Spain --Section 6a
55. G. Salmè, Istituto nazionale di Fisica Nucleare, Italy –Section 2a
56. H. Sanchis Alepuz, , University of Graz, Austria, –Section 2c
57. G. Schnell, DESY, Germany --Section 8a
58. S. Scopetta, University of Perugia, Italy –Section 2a
59. N. Stefanis, Institute for Theoretical Physics II, Germany – Section 8a
60. G. de Teramond, Universidad de Costa Rica, Costa Rica –Section 4a
61. N. Tsirova, Universite Blaise Pascal, France --Section 9b
62. J. Vary, Iowa State University, USA –Section 1a
63. A. Vega, Universidad Tecnica Federico Santa Maria, Chile –Section 4b
64. M. Weinstein, SLAC, USA –Section 3b
65. N. Wschebor, Universidad de la República, Uruguay –Section 3a
66. I. Zahed, Stony Brook University, USA --Section 7a

Posters

1. S. Dalley, Southern Methodist University, USA
2. F. J. Llanes Estrada, Univ. Complutense Madrid, Spain
3. Hee-Jung Lee, Chungbuk National University, South Korea
4. M. Soleymaninia, Semnan University,

Light Cone 2010
Relativistic Hadronic and Particle Physics

Section 01

Light front field theory and other nonperturbative approaches

Non-Perturbative Hamiltonian Light Front Field Theory - Progress and Prospects

James P. Vary
Iowa State University, USA

Fundamental theories, such as Quantum Chromodynmamics (QCD) and Quantum Electrodynamics (QED) offer the promise of great predictive power spanning phenomena on all scales from the microscopic to cosmic scales. However, new tools that do not rely exclusively on perturbation theory are required to build bridges from one scale to the next. I will outline recent theoretical and computational progress to build these bridges and provide illustrative results from Hamiltonian Light Front Field Theory. The more recent developments capitalize on advances in algorithms and computers to solve very large sparse matrix eigenvalue problems.

Field Theory on the Light Front

J.-F. Mathiot
Universit Blaise Pascal,France

I shall present the main steps for setting up field theory on the light front, in order to have a well defined approximation scheme, and a systematic strategy to improve, and control, the approximations. This includes: 1. Control of rotational invariance to be able to define unambiguously physical observables [1]; 2. Control of uncancelled divergences when the Fock state expansion is truncated [2]: 3. Identify the whole set of particle-antiparticle components at each step of the Fock space truncation to completely remove divergences: 4. Use of an adequate regularization scheme, the Taylor-Lagrange renormalization scheme, to preserve symetries and avoid any infinite mass scale limit and divergences[3]. We shall present applications in the three-body truncation in the Yukawa model (anomalous magnetic moment), in a pure scalar model to identify the complete set of components including particle-antiparticles, and finally present a new formulation of chiral effective field theory for baryons [4].

References

[1] J. Carbonell et al. Phys. Rep. 300 (1998) 215.

[2] V. Karmanov, J.-F. Mathiot, A. Smirnov, Phys. Rev. D77 (2008) 085028.

[3] P. Grange, et al., Phys. Rev. D80 (2009) 105012.

[4] J.-F. Mathiot, PoS(EFT2009)014.

Momentum and position variables in light-front Hamiltonians and wave functions

S. D. Glazek
University of Warsaw,Poland

Standard light-front momentum variables used for description of relative motion of bound-state constituents and particles created or annihilated by interaction terms in renormalized Hamiltonians in quantum field theory, typically denoted for + and perp components as $p = xP + k$, where p is a constituent's or interacting particle's momentum, x is the fraction of + component of the relevant total momentum P, and k has only perp components different from 0, are not simply related through a Fourier transform to the space-time position variables for the same particles on the light-front hyperplane because the + momenta are only positive and x is limited to the range between 0 and 1. Nevertheless, the variables x and k can be handled in a way which leads to identification and visualization of the wave functions and Hamiltonian interaction densities as functions of the position-space variables. The same way of handling x and k also shows how the canonical local interactions can emerge from non-local renormalized Hamiltonians when the renormalization group invariant mass scale parameter of an effective theory tends to infinity.

Electron in a transverse harmonic cavity

H. Honkanen[*], P. Maris, J. Vary, and S. Brodsky
Iowa State University, USA

We employ Hamiltonian light-front quantum field theory in a basis function approach to solve the non-perturbative problem of an electron in a strong scalar transverse confining potential. We evaluate both the invariant mass spectra and the anomalous magnetic moment of the lowest state to provide results for this complicated two-scale system - useful for testing other approaches to field theory at strong coupling. The weak external field limit of the anomalous magnetic moment agrees with the result of QED perturbation theory to within the anticipated accuracy.

[*]speaker

Relativistic three-body model for final state interaction in $D^+ \to K^-\pi^+\pi^+$ decay

T. Frederico*, K.S.F.F. Guimares, W. de Paula,
I. Bediaga, A. Delfino, A. C.dos Reis, and L. Tomio
Instituto Tecnológico de Aeronáutica,
São José dos Campos, Brazil

We develop a relativistic three-model model for the final state interaction in $D^+ \to K^+\pi^-\pi^-$ decay based on the ladder approximation of the Bethe-Salpeter equation. The decay amplitude is separated in a smooth term and a three-body fully interacting contribution, that is factorized in the standard two-meson resonant amplitude times a reduced complex amplitude that carries the effect of the three-body rescattering mechanism. The off-shell reduced amplitude is a solution of an inhomogeneous Faddeev type integral equation, that has as input the S-wave isospin 1/2 $K^+\pi^-$ transition matrix. The parameters of the S-wave isospin 1/2 $K^+\pi^-$ scattering matrix is fitted to the experimental LASS data. The integral equation is solved numerically and the modulus of the amplitude and phase is compared to the the E791 experiment and FOCUS analysis.

*speaker

String Gauge Symmetries in the Light-Front Polyakov D1 Brane Action

Daya Shankar Kulshreshtha
Department of Physics, Kirori Mal College,
University of Delhi, Delhi-110007, India

We investigate the question of string gauge symmetries for the conformally gauge-fixed light-front Polyakov D1 brane action in the presence of background gauge fields.

Pair production in laser fields: finite size effects

Anton Ilderton
Dept. Physics, Umeå Univeristy, Sweden

We discuss pair creation in a strong laser background, using lightcone field theory. We show that all the physics is contained in the lightcone momentum transfer from the laser, and probes, to the produced pair. The dependence of this momentum transfer on the geometry of the laser leads to resonance and diffraction effects in the pair production cross section. The lightcone approach also naturally explains the interpretation of laser stimulated pair production as a multi-photon process creating pairs of an effective mass.

References

[1] T. Heinzl, A. Ilderton and M. Marklund, "*Finite size effects in stimulated laser pair production*", arXiv:1002.4018 [hep-ph].

[2] T. Heinzl and A. Ilderton, "*Exploring high-intensity QED at ELI*", Eur. Phys. J. D **55** (2009) 359 [arXiv:0811.1960 [hep-ph]].

Light-Front Quantization of Chern-Simons-Higgs Theory in the Symmetry Phase

Usha Kulshreshtha
Department of Physics, Kirori Mal College,
University of Delhi, Delhi-110007, India

Light-front quantization of Chern-Simons-Higgs theory is studied in the symmetry phase using the Hamiltonian, path integral and BRST formulations.

Pauli–Villars regularization of field theories on the light front

John R Hiller
University of Minnesota-Duluth

Four-dimensional quantum field theories generally require regularization to be well defined. This can be done in various ways, but here we focus on Pauli–Villars (PV) regularization and apply it to nonperturbative calculations of bound states. The philosophy is to introduce enough PV fields to the Lagrangian to regulate the theory perturbatively, including preservation of symmetries, and assume that this is sufficient for the nonperturbative case. The numerical methods usually necessary for nonperturbative bound-state problems are then applied to a finite theory that has the original symmetries. The bound-state problem is formulated as a mass eigenvalue problem in terms of the light-front Hamiltonian. Applications to Yukawa theory and quantum electrodynamics will be discussed.

Nonperturbative calculations in light-front QED

Sophia Chabysheva
University of Minnesota-Duluth

The methods of light-front quantization and Pauli-Villars regularization are applied to a nonperturbative calculation of the dressed-electron state in quantum electrodynamics. This is intended as a test of the methods in a gauge theory, as a precursor to possible methods for the nonperturbative solution of quantum chromodynamics. The electron state is truncated to include at most two photons and no positrons in the Fock basis, and the wave functions of the dressed state are used to compute the electrons's anomalous magnetic moment. A choice of regularization that preserves the chiral symmetry of the massless limit is critical for the success of the calculation.

Light Cone 2010
Relativistic Hadronic and Particle Physics

Section 02

Relativistic Nuclear and Hadron structure

Two-body current operators and elastic electron-deuteron scattering in the Light-front Hamiltonian Dynamics

G. Salmè *, E. Pace, A. Marinho
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Piazzale Aldo Moro 2, 00185 Rome Italy

The deuteron electromagnetic form factors, $A(Q^2)$ and $B(Q^2)$, and the tensor polarization, $T_{20}(Q^2)$, are unambiguously calculated within the Light-front Hamiltonian Dynamics, by using a novel current, built up from i) a one-body term and ii) two-body currents, extracted from a Ward-Takashi analisys of a covariant Yukawa model. Each contribution fulfills extended Poincare' covariance and Hermiticity.

*speaker

Poincare Invariant Quantum Mechancis based on Euclidean Green functions

W. Polyzou*, P. Kopp
University of Iowa,USA

We present a method for constructing relativistic quantum mechanical models of a finite number of degrees of freedom that are defined in terms of model Euclidean Green functions. We discuss methods for calculating spectral properties, scattering observables, and finite Poincaré transforms without using analytic continuation. Cluster properties are easy to realize in this formalism. Open problems related to reflection positivity are discussed. Preliminary calculations of scattering observables in a related toy model are presented.

*speaker

Generalized parton distributions and the parton structure of light nuclei

Sergio Scopetta
University of Perugia and INFN, sezione di Perugia

The measurement of nuclear Generalized Parton Distributions (GPDs) represents a valuable tool to understand the structure of bound nucleons and the phenomenology of hard scattering off nuclei. By using a realistic, non-relativistic microscopic approach for the evaluation of GPDs of ^{3}He, it will be shown that conventional nuclear effects, such as isospin and binding ones, or the uncertainty related to the use of a given nucleon-nucleon potential, are bigger than in the forward case so that, if great attention is not paid, conventional nuclear effects can be easily mistaken for exotic ones. It is stressed that ^{3}He, for which the best realistic calculations are possible, represents a unique target to discriminate between conventional and exotic effects [1, 2]. The complementary information which could be obtained by using a ^{3}H target, the possible extraction of the neutron information, as well as the relevance of a relativistic treatment, will be also addressed.

References

[1] S. Scopetta, Phys. Rev. C **79**: (2009) 025207.

[2] S. Scopetta, Nucl. Phys. **A** 790 (2007) 364.

Solving Bethe-Salpeter equation for two fermions in Minkowski space

V.A. Karmanov* and J. Carbonell
Lebedev Physical Institute, Russia

Euclidean Bethe-Salpeter (BS) equation is enough to find the binding energy. However, to calculate e.m. form factors, the Minkowski BS amplitude is needed. Recently we developed a new method of solving BS equation in Minkowski space for the spinless particles. The method was based on the Nakanishi integral representation and on projecting the BS equation on the light-front plane. Now we extend this method to a system.

*speaker

Parameters in a Walecka-type model for the deuteron

B.L.G. Bakker
Department of Physics and Astrophysics, Vrije Universiteit,
De Boelelaan 1081, NL-1081 HV Amsterdam,
The Netherlands

This document details a proposal, first put forward at the Workshop on relativity in Trento, 2009, for a benchmark calculation of the deuteron form factors. The purpose of the benchmark is to define more accurately what we mean by 'relativistic effects'. A first step to that goal is made here: We define a model Lagrangean in the spirit of the Walecka model, namely one having only a scalar meson σ, and a vector one, ω. In order to regularize this model, two Pauli-Villars particles are introduced, one regularizing the scalar exchange and one regularizing the vector exchange.

PS-meson form factors in relativistic quantum mechanics and constraints from covariant space-time translations

Bertrand Desplanques
LPSC-Grenoble

The role of Poincaré covariant space-time translations is investigated for RQM approaches to the pseudoscalar-meson charge form factors. It is shown that this role extends beyond the standard energy-momentum conservation, which is accounted for in all calculations. It implies constraints that have been largely ignored until now but should be fulfilled to ensure the full Poincaré covariance. The violation of these constraints, which is more or less important depending on the form of relativistic quantum mechanics that is employed, points to the validity of using a single-particle current, which is generally assumed in calculations of form factors. In short, these constraints concern the relation of the momentum transferred to the constituents to the one transferred to the system. How to account for the related constraints, as well as restoring the equivalence of different relativistic quantum mechanics approaches in estimating form factors, is discussed.

Relativistic point-form approach to hadron properties

Willibald Plessas
Institute of Theoretical Physics, University of Graz

We present a review of the description of hadron properties along an invariant mass operator in the point form of Poincare-invariant relativistic dynamics. The quark-quark interaction is furnished by a linear confinement, consistent with the QCD string tension, and a hyperfine interaction derived from Goldstone-boson exchange. The main advantage of the point-form approach is the possibility of calculating manifestly covariant observables, since the generators of Lorentz transformations remain interaction-free. We discuss the static properties of the mass-operator eigenstates, such as the invariant mass spectra of light- and heavy-flavor baryons, the characteristics of the eigenstates in terms of their spin, flavor, and spatial dependences as well as their classification into spin-flavor multiplets. Regarding dynamical observables we address the electroweak structures of the nucleon and hyperon ground states, including their electric radii, magnetic moments as well as axial charges, furthermore hadronic decays of baryon resonances and a recently derived microscopic description of the πNN as well as $\pi N\Delta$ interaction vertices. Except for the resonance decays, most of these observables are obtained in good agreement with existing phenomenology. Relativistic (boost) effects are generally sizable.

Nucleon properties from a covariant Faddeev equation approach

Helios Sanchis-Alepuz*, Reinhard Alkofer
Department of Theoretical Physics - Institut fr Physics
Karl Franzens Universitt Graz, Austria

We show a recent solution of the nucleon's covariant Faddeev equation in an explicit three-quark approach. The full Poincare-covariant structure of the three-quark amplitude is implemented through an orthogonal basis obtained from a partial-wave decomposition. The nucleon's binding is generated by an iterated dressed gluon exchange between any two quarks. Such an interaction allows for a comparison with previous meson and quark-diquark studies and is compatible with aspects of chiral symmetry and its spontaneous breaking. The resulting current-mass evolution of the nucleon mass compares well with lattice data and deviates only by $\sim 5\%$ from the quark-diquark result.

*speaker

$\eta - \eta'$ Mixing from the Chiral Lagrangian

Vincent Mathieu
Universidad de Valencia, Spain

Under large-N arguments the flavor singlet η_0 can be considered as the ninth Goldstone boson. Its inclusion in a effective low-energy Lagrangian, the chiral Lagrangian, leads to a mixing with η_8 forming two physical states, η and η'.

The $\eta - \eta'$ mixing scheme is studied at leading order and next to leading order in the momentum expansion. It is demonstrated that the leading order is not sufficient to reproduce the dynamics of the $\eta - \eta'$ system. I will expose two improvements. The first one consists on the inclusion at leading order of third state mainly gluonic and the second on going at next to leading order in the momentum expansion.

The next to leading order terms accommodate the two physical particles but involve low-energy constants without a clear physical meaning. It will be shown how to reorganize the low energy constants to express the mass matrix in terms of the decay constants. Under a well defined hypothesis, the decay constants and the mixing angle of the $\eta - \eta'$ system is predicted in agreement with experimental data.

This procedure leads to the explanation the Feldmann, Kroll and Stech formalism without resorting to an *ad hoc* assumption about the decay constants. The same mass matrix, and hence the same predictions, are recovered with a better understanding.

References

[1] V. Mathieu and V. Vento,
"Pseudoscalar glueball and $\eta - \eta'$ mixing,"
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arXiv:0910.0212 [hep-ph].

[2] V. Mathieu and V. Vento,
"$\eta - \eta'$ Mixing in the Flavor Basis and Large N,"
Phys. Lett. B **688** (2010) 314
arXiv:1003.2119 [hep-ph].

Light Cone 2010
Relativistic Hadronic and Particle Physics

SECTION 04

Non-perturbative methods and renormalization theory

New insights on non perturbative Yang-Mills

Daniele Binosi
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I-38123 Villazzano, Trento, Italy

I will review the recent progress (achieved through lattice, Schwinger-Dyson equations, and BRST related approaches) in understanding the non-perturbative sector of QCD.

From unphysical gluon and ghost propagators to physical glueball propagators (in the Gribov-Zwanziger picture): a not so trivial task ?

David Dudal
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Krijgslaan 281 S9, 9000 Gent, Belgium

During recent years, a good agreement was found between the analytical derivation and the numerical simulation of the Landau gauge gluon and ghost propagators. We mention the Schwinger-Dyson and Gribov-Zwanziger formalism for the analytical work. Seemingly, we have found the "correct" nonperturbative propagators.

Although the agreement between several approaches is nice, these propagators do not correspond to the relevant physical degrees of freedom. In the case of pure gauge theories, one should start to study the glueball correlators. We shall try to explain why it looks like a hard challenge to go from the unphysical to the physical propagators in the case of the Gribov-Zwanziger theory (but similar conclusions might hold for other approaches giving similar propagators).

Infrared propagators of Yang-Mills theory from perturbation theory

Nicolás Wschebor
Universidad de la República, Montevideo

We show that the correlation functions of ghosts and gluons for the pure Yang-Mills theory in Landau gauge can be accurately reproduced for all momenta by a one-loop calculation. The key point is to use a massive extension of the Faddeev-Popov action. The agreement with lattice simulation is excellent in $d = 4$. The one-loop calculation also reproduces all the characteristic features of the lattice simulations in $d = 3$ and naturally explains the pecularities of the propagators in $d = 2$.

References

[1] M. Tissier and N. Wschebor, arXiv:1004.1607 [hep-ph].

The low-momentum ghost dressing function and the gluon mass

J. Rodriguez-Quintero
Universidad de Huelva, CAFPE, Spain

We study the low-momentum ghost propagator Dyson-Schwinger equation (DSE) in Landau gauge, assuming for the truncation a constant ghost-gluon vertex, as it is extensively done, and a simple model for a massive gluon propagator. Then, regular DSE solutions (the zero-momentum ghost dressing function not diverging) appear to emerge and we show the ghost propagator to be described by an asymptotic expression reliable up to the order $\mathcal{O}(q^2)$. That expression, depending on the gluon mass and the zero-momentum Taylor-scheme effective charge, is proven to fit pretty well the low-momentum ghost propagator obtained through the numerical integration of the coupled gluon and ghost DSE in the PT-BFM scheme and also through big-volume lattice simulations.

Massive Degeneracy and Goldstone Bosons, A Challenge for the Light Front

Marvin Weinstein
SLAC, Stanford University, USA

Given past discussions at Light Cone Meetings it seems worth briefly reviewing the physics of spontaneous symmetry breaking and why it implies massive degeneracy. I will touch on old experimental evidence, from PCAC (chiral symmetry) etc. to argue we know hadronic physics exhibits this approximate degeneracy. Finally, I will explain the simple reason why strong coupling Hamiltonian lattice QCD exhibits this behavior and repose, in this context, the challenge for the light front formulation.

Hamiltonian formulation of the exactly solvable models and their vacuum structure

Lubomir Martinovic
Institute of Physics SAS, Bratislava, Slovakia,*
BLTP JINR, Dubna, Russia †

Simple two-dimensional models with massless and massive fermions are studied in the Hamiltonian framework. One of the motivations is to understand better the relationship between the usual (space-like) and light-front forms of field theory. The correct quantum Hamiltonians that incorporate knowledge of the operator solutions of the field equations, are derived. While the derivative-coupling model is found to be equivalent to a free theory, the physical vacua of the massless Thirring and Federbush models are obtained by means of a Bogoliubov transformation in the form of a coherent state quadratic in composite boson operators. The corresponding non-perturbative correlation functions are computed. The massive version of the Klaiber's current bosonization is constructed in the both space-like and light-front forms. After showing that the Federbush model has the same interacting structure in the both schemes, it is used for a detailed non-perturbative comparison between the two forms of the relativistic dynamics.

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*permanent address
†current address

Taylor-Lagrange Renormalisation: Self-energy of the gauge boson.

P.Grangé*, B.Mutet, E Werner,
CNRS-IN2P3, Montpellier, Theoretische Physik, Regensburg

The Lorentz structure of the gauge boson self-energy to one loop is shown to emerge naturally in the TLR scheme, directly at the physical dimension $D = 4$. Possible consequences on the fate of quadratic divergences in the Standard Model are pointed out.

*speaker

The fine tuning problem revisited in the light of the Taylor-Lagrange renormalization scheme.

P. Grange, J-F Mathiot, B. Mutet*, and E. Werner
LPTA, Montpellier, France

We calculate the radiative corrections to the Higgs mass to the first loop order using both the usual sharp cut-off procedure and Taylor-Lagrange renormalization scheme (TLRS). Results appear to differ significantly. The TLRS results allow for a different interpretation of the Higgs renormalized mass. The fine tuning issue is discussed.

*speaker

Section 04

AdS/CFT overview and applications to strongly interacting systems

TBA

A. Pomarol
IFAE and UAB, Barcelona, Spain

Gauge/Gravity Duality and Strongly Coupled Light-Front Dynamics

Guy F. de Teramond
Escuela de Fisica, Universidad de Costa Rica,
San Jose 1000, Costa Rica

Starting from the relativistic bound state Hamiltonian equation of motion in QCD, we discuss the remarkableconnection between a semiclassical approximation to QCD quantized on the light-front(LF) and its dual gravity representation in anti-de Sitter (AdS) space. We also discuss the holographic mapping of hadronic transition matrix elements in AdS with with the corresponding expressions for matrix elements using LF theory in physical space time. Applications to the light meson and baryon spectrum and form factors are presented. The gauge/gravity correspondence also allows us to identify a non-perturbative effective coupling $\alpha_s^(Q^2)$ which incorporates color confinement and agrees well with the effective strong coupling determined from JLab data.

Light and heavy mesons in soft-wall holographic approach

Valery E. Lyubovitskij
Universität Tübingen, Germany

Mass spectrum and decay properties of light and heavy mesons are considered in soft-wall holographic approach [1] based on the correspondence of string theory in AdS space and conformal field theory in physical space-time [2]. Our approach is based on ideas of light-front holography approach developed by Brodsky and de Téramond [3]. The model generates linear in n and $J(L)$ Regge trajectories. Results obtained for heavy-light mesons are consistent with predictions of HQET.

References

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Considering anomalous dimensions in AdS/QCD models

Alfredo Vega* and Ivan Schmidt
Universidad Tecnica Federico Santa Maria, Chile

We discuss an holographical model which consider anomalous dimension, this introduce a z dependence in mass of AdS modes associated to operators.

*speaker

2-forms in holographic QCD

L. Cappiello, O. Catà* and G. D'Ambrosio
IFIC and Universidad de Valencia, Spain

Applications of the AdS/CFT correspondence to QCD have so far concentrated on 0-form (scalar and pseudoscalar) and 1-form (vector and axial) fields. However, a consistent application of the AdS/CFT conjecture should also include a gauge theory description for the 2-form fields present in the supergravity side. In this talk I will show how to use the holographic prescription to describe 2-forms, which in QCD turn out to involve both ρ-mesons (1^{--} states) and b1-mesons (1^{+-} states), covering both formal and phenomenological aspects.

*speaker

Light Cone 2010
Relativistic Hadronic and Particle Physics

Section 05

Recent results in perturbative QCD

TBA

N. Glover
IPPP Durham, United Kingdom

Feynman's Tree Theorem and loop-tree dualities

G. Rodrigo
IFIC Valencia

May 27, 2010

Scattering amplitudes at one-loop in relativistic, local and unitary field theories can be calculated, from tree diagrams, through the Feynman's Tree Theorem, by applying multiple cuts to the internal lines. We have recently proposed a duality relation between one-loop and tree scattering amplitudes where only single-cuts are needed [1]. This duality relation is realized by a non-trivial modification of the customary +i0 prescription of the Feynman propagators. In this talk we extend the duality theorem beyond the one-loop level [2].

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Q2-evolution of parton densities at small-x values

A.Yu. Illarionov,* A.V. Kotikov
Dipartimento di Fisica, Universitá di Trento, Italy

In the leading twist approximation of the Wilson operator product expansion with "frozen" and analytic strong coupling constants we show that Bessel-inspired behavior of the structure function F_2 at small x, obtained for a flat initial condition in the DGLAP evolution equations, leads to good agreement with the deep inelastic scattering experimental data from HERA.

*speaker

Quark-hadron duality violation in QCD Sum Rules with hadronic τ data

Martín González-Alonso
Departament de Física Teòrica and IFIC,
Universitat de València-CSIC

June 17th, 2010

I will explain how to estimate the quark-hadron duality violation present in any QCD Sum Rule [1] using a very general parametrization. I will present the numerical results obtained in certain Finite Energy Sum Rules [2, 3], that are interesting for obtaining the chiral low-energy constants L_{10} and C_{87} and the dimension six and eight contributions in the OPE of the left-right correlator.

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Heavy quark flavour dependence of multiparticle production in QCD jets

Redamy Perez Ramos*, Vincent Mathieu, and
Miguel-Angel Sanchis Lozano
Departamento de Fisica Teorica,
Universidad de Valencia and IFIC, Spain

After inserting the heavy quark mass dependence into QCD partonic evolution equations, we determine the NLO mean average charged hadron multiplicity and second multiplicity correlators of jets produced in high energy collisions. We thereby extend the so-called dead cone effect to the phenomenology of multiparticle production in QCD jets and find that the average multiplicity of heavy-quark initiated jets decreases significantly as compared to the massless case, even taking into account the weak decay products of the leading primary quark. We emphasize the relevance of our study as a complementary check of b-tagging techniques at hadron colliders like the Tevatron and the LHC.

*speaker

Section 06

Lattice and hamiltonian QCD

Hadron structure from Lattice QCD

Ph. Haegler
TU Muenchen, Germany

TBA

The History and Status of High-Precision Lattice QCD

G. Peter Lepage
Cornell University

Lattice QCD was invented within months of the invention of QCD, but this approach to nonperturbative QCD largely stalled for its first 25 years. A series of developments in the past decade have finally made realistic numerical simulations of nonpertubative QCD feasible. The result has been a series of important calculations with unprecedented precision (percent-level). This talk will begin with an introduction to lattice simulations. It will then sketch the developments that have made high precision possible, and summarize some of the more significant results. It will end with a discussion of the limitations of lattice QCD.

Gluon Structure Function in Hamiltonian Lattice QCD

H.J.Pirner*, M. Ilgenfritz and D. Gruenewald
University of Heidelberg, Germany

We calculate the gluon structure function of a color dipole in a new approach evaluating the matrix elements of SU(2) gluon field operators separated along a direction close to the light cone. As vacuum state in the pure glue sector, we use a variational ground state of the near-light-cone Hamiltonian. With a mean momentum fraction of the gluons fixed to the "experimental value" in a proton, the resulting gluon structure function for a dipole state with four links is compared qualitatively to the NLO *MRST* 2002 parameterization at $Q^2 = 1.5\text{GeV}^2$.

*speaker

Pion wave function from lattice QCD, transversity relations and chiral quark models

Wojciech Broniowski, Sasa Prelovsek, Luka Santelj,
Enrique Ruiz Arriola*
Universidad de Granada, Spain

We analyze the equal-time Bethe-Salpeter quark wave function of the pion obtained from a quenched lattice QCD calculation with delocalized quark interpolators. We find that the result agrees remarkably well with the predictions of the Nambu–Jona-Lasinio model in all channels. We choose the quenched lattice QCD, since it is closer to the large-N_c limit of the Nambu–Jona-Lasinio model. We also show how transversity information, relevant for the light-cone physics, can be obtained from our equal-time rest-frame lattice calculations.

*speaker

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Relativistic Hadronic and Particle Physics

Section 07

Relativistic heavy ion physics

ALICE Physics program

Gines Martinez for the ALICE collaboration
Subatech, France

TBA

The chiral magnetic effect and local parity violation at RHIC

D. Kharzeev
Brookhaven National Laboratory, USA

I will discuss the phenomena emerging from the interplay of chiral charge and magnetic field in QCD coupled to electromagnetism.

High-energy heavy-ion physics: status report

David d'Enterria
ICREA, Universidad de Barcelona, Spain

A concise review of the experimental and phenomenological progress in high-energy heavy-ion physics over the past years will be presented. Emphasis will be put on measurements at BNL-RHIC and CERN-SPS which provide information on fundamental properties of QCD matter at extreme values of temperature, density and low-x. The new opportunities accessible at the LHC, which may help clarify some of the current open issues, will be also outlined.

Dileptons and Photons at RHIC

Ismail Zahed
Stony Brook University, USA

I will discuss the dilepton and photon rates in relativistic heavy ion collisions from the SPS, to RHIC and LHC.

TBA

N. Armesto
Universidad de Santiago de Compostela, Spain

TBA

Quasi-Classical Model in SU(N) Gauge Field Theory

A.V.Koshelkin
Moscow Institute for Physics and Engineering, Russia

The exactly solved quasi-classical model in a gauge theory with the classical Yang-Mills (YM) field is developed. On a basis of the exact solution of the Dirac equation in the $SU(N)$ gauge field which is in the form a plane wave the Yang-Mills equations with an external current are solved. The developed model admits the self-consistent solutions of the Dirac and Yang-Mills equations at $N \geq 3$. The derived solutions take place provided that the fermion and gauge fields exist simultaneously, so that the whole compensation of the fermion current by the current generated by the gauge field due to the its self-interaction occurs. Thereat, there is no energy flux form the confined region os space where the fields are concentrated. The obtained solution are discussed in the context of QCD. The renoramlization of a quark mass due the interactions of quarks with a gluon field is calculated.

Progress in Lattice QCD at non-zero temperature and QGP

Peter Petreczky
Brookhaven National Laboratory, USA

I will review recent progress in lattice QCD at finite temperature, including the study the deconfinment and chiral aspect of the transition, equation of state and comparison of lattice results with phenomenological models.

Alice First Physics Results

Leticia Cunqueiro
INFN-Frascati

ALICE first physics results will be presented.
The pseudorapidity density and multiplicity distribution of charged particles produced in proton proton collisions at the LHC at a centre-of-mass energy of $\sqrt{s}$ = 0.9, 2.36 and 7 TeV [1,2,3] are presented. Preliminary results on the unidentified charged p_T spectra at 0.9 TeV, on baryon production at 0.9 and 7 TeV and on HBT femtoscopy at 0.9 TeV are reported.

References

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Photon-induced interactions in ultra-peripheral collisions

Zaida Conesa del Valle
IPHC, Université de Strasbourg, CNRS-IN2P3, France

Photon fluxes generated by proton and nuclei accelerated at collider energies open up the possibility to study $\gamma\,\gamma$, $\gamma\,n$ (photon- nucleon) and $\gamma\,A$ (photon-nuclear) interactions [1]. These photon-induced reactions are an interesting approach to study strong and electromagnetic interactions, complementary to e^+e^-, ep (DIS), pp and $p\bar{p}$ collisions. RHIC results on di-leptons, rho and J/ψ mesons photoproduction will be discussed [2, 3]. The prospects to study ultra-peripheral collisions at the LHC will also be outlined [1].

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Light Cone 2010
Relativistic Hadronic and Particle Physics

Section 08

GPDs, DVCS and TMDs

Transverse spin structure of hadrons

Matthias Burkardt
New Mexico State University, USA

Parton distributions in impact parameter space, which are obtained by Fourier transforming GPDs, are exhibit a significant deviation from axial symmetry when the target and/or quark is transversely polarized. In combination with the final state interactions, this transverse deformation provides a natural mechanism for naive-T odd transverse single-spin asymmetries in semi-inclusive DIS. The deformation can also be related to the transverse force acting on the active quark in polarized DIS at higher twist.

Recent developments at HERMES

G. Schnell [for the HERMES collaboration]
DESY, Germany

During more than a decade of running HERMES took data with a variety of targets and detector setups. While the early years were dedicated to the study of the quark-spin contribution to the proton spin, the emphasis in the the latter years are on obtaining 3-dimensional pictures of the proton structure either via transverse-momentum-dependent distribution functions (TMDs) or generalized parton distributions (GPDs). In this talk, HERMES milestones in these studies will be reviewed and an overview of recent results and developments including outlook will be given.

Role and properties of Wilson lines in TMD PDFs

N. G. Stefanis
Ruhr University Bochum, D-44780 Bochum, Germany

It is suggested that Wilson lines introduced to ensure the gauge invariance of transverse-momentum dependent (TMD) parton distribution functions (PDF)s inevitably involve contours joined non-smoothly by a cusp at light-cone infinity. It is argued that to dispense with the entailed cusp anomalous dimension in the light-cone gauge adjoint with q^--independent pole prescriptions, one has to modify the definition of TMD PDFs by an eikonal factor along a specific cusped contour with segments in the transverse direction. Alternatively, one may use the Mandelstam-Leibbrandt q^--dependent pole prescription avoiding this problem ab initio and reproducing the results of covariant gauges. An extension of the formalism to the case of polarized TMD PDFs is proposed, emphasizing the key issues of gauge invariance and working out their renormalization properties.

Gauge invariance and causality in exclusive and inclusive processes

I.V. Anikin* and O. V. Teryaev
BLTP, JINR, Russia

We discuss an unified approach for study of the gauge invariance in the processes the factorized amplitudes of which include one and two soft non-perturbative parts.

*speaker

Spin Filter and GPD in DVCS Amplitudes

Chueng-Ryong Ji[1]*and Bernard L.G. Bakker[2]
[1]Department of Physics, North Carolina State University,
Box8202, Raleigh, NC 27695-8202, USA
[2]Department of Physics and Astrophysics, Vrije Universiteit,
De Boelelaan 1081, NL-1081 HV Amsterdam, The Netherlands

In deeply virtual Compton scattering (DVCS), we discuss our recent findings that in some kinematics angular momentum is not conserved if the amplitudes are calculated in terms of widely used reduced operators. In particular, we discuss an issue of extracting the generalized parton distribution (GPD) from the DVCS amplitudes and compare the results between the full calculation of the tree level Compton scattering amplitude and the reduced calculation using the GPD formulation. In the kinematics with the large transverse momentum, not only the contribution of the longitudinally polarized virtual photon should not be neglected in the analysis of DVCS amplitudes but also the wrong analysis of experimental data would be resulted in terms of GPDs.

*speaker

T-odd TMDs in Quark Models

Aurore Courtoy
INFN-Pavia

We present a general formalism for the evaluation of time-reversal odd parton distributions [1]. This formalism is then applied to the evaluation of the Sivers [1, 2] and the Boer-Mulders [3] functions. We have performed the calculation for two different models of proton structure: a constituent quark model and the MIT bag model. In the latter case, we have found important differences with respect to a previous calculation in the same framework, for both the Sivers and Boer-Mulders functions. All the results we have obtained are consistent with the present knowledge, e.g., signs of the u and d distributions, the Burkardt sum rule is fulfilled (in the case of the Sivers function).

References

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Quadrupole moment of the nucleon in chiral constituent quark model

Harleen Dahiya* and Neetika Sharma
Department of Physics,
Dr. B.R. Ambedkar National Institute of Technology,
Jalandhar, 144011, India.

The electromagnetic form factors have attracted lot of theoretical and experimental attention recently as they encode extensive information on the internal structure of the hadron. An understanding of the form factors is necessary to describe the strong interactions as they are sensitive to the pion cloud and provide a test for the QCD inspired effective field theories based on the chiral symmetry. The internal structure of the nucleon and the shape of a spatially extended particle is determined by its *intrinsic* quadrupole moment which can be related to the charge radii. In view of the very exciting recent developments in the field, we propose to apply the techniques of chiral constituent quark model to measure the deformation of the nucleon using the quadrupole moment. We have calculated the nucleon charge radii and the intrinsic quadrupole moment of the nucleon in the framework of chiral constituent quark model. The results obtained are comparable to the latest experimental studies and also show improvement over some theoretical interpretations.

*speaker

GTMDs in Light-Cone Models

Cédric Lorcé
Mainz University

Generalized Transverse Momentum Distributions (GTMDs) are new parton correlation functions which reduce either to GPDs or to TMDs in particular kinematical limits. In absence of longitudinal momentum transfer, they give the distribution of parton three-momentum and transverse position in the nucleon.

Studying the analytical structure of the light-cone wave function associated with the 3 quark Fock state, we derived a unifying scheme [1] which allows us to write down explicit expressions for the GTMDs, common to many relativistic models like SU(6) Light-Cone Quark Model, Chiral Quark-Soliton Model in the Infinite Momentum Frame and Bag models.

References

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Timelike Virtual Compton Scattering from Electron-Positron Radiative Annihilation

A. Mukherjee*, A. Afanasev, S. J. Brodsky, C. Carlson
IIT Bombay, India

We propose measurements of the deeply virtual Compton amplitude (DVCS) $\gamma^* \to h\bar{h}\gamma$ in the timelike $t = (p_h + p_{\bar{h}})^2 > 0$ kinematic domain which is accessible at electron-positron colliders via the radiative annihilation process $e^+e^- \to h\bar{h}\gamma$. These processes allow the measurement of timelike deeply virtual Compton scattering for a variety of $h\bar{h}$ hadron pairs such as $\pi^+\pi^-$, K^+K^-, and $D\bar{D}$ as well as $p\bar{p}$.

*speaker

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Relativistic Hadronic and Particle Physics

Section 09

The pion transition form factor and the BaBar data

Shape of the pion distribution amplitude

M.V. Polyakov
Ruhr-University Bochum, Germany

We argue that the recent BaBar data on $\gamma \to \pi$ e.m. transition form factor at large photon virtuality supports the idea that pion distribution amplitude (DA) is close to unity with $\phi'_\pi(0)/6 \gg 1$ at a normalization point of $\mu = 0.6 \div 0.8$ GeV. Such pion DA can be obtained in the effective chiral quark model. The possible flat shape of the pion DA implies that the standard expansion of the DA in Gegenbauer polynomials can be divergent. On basis of chiral models we predict that the two-pion DA should exhibit anomalous endpoint behaviour for pions in the S-wave and that such feature is absent for higher partial waves. The latter implies that the ρ, f_2, etc. meson DAs have no anomalous endpoint behaviour. Possible implications of such pion DA for other hard exclusive processes are shortly discussed.

Measurement of the $\gamma\,\gamma^* \to \pi_0$ transition form factor

M. Dubrovin for the BABAR Collaboration
University of Cincinnati, USA

We study the reaction $e^+e^- \to e^+e^-\pi_0$ in the single tag mode and measure the differential cross section and the $\gamma\,\gamma^* \to \pi_0$ transition form factor in the momentum transfer range from 4 to 40 GeV^2. The analysis is based on 442 fb^{-1} of integrated luminosity collected at PEP-II with the BABAR detector at e^+e^- center-of-mass energies near 10.6 GeV.

Photon-pion transition form factor within nonlocal chiral quark model

A. E. Dorokhov
Joint Institute for Nuclear Research,
Bogoliubov Laboratory of Theoretical Physics,
141980 Dubna, Moscow region, Russian Federation

Recently, the BABAR collaboration published (arXiv:0905.4778) data for the photon-pion transition form factor $F_{\pi\gamma\gamma^*}(Q^2)$, which are in strong contradiction to the predictions of the standard factorization approach to perturbative QCD. Immediately afterwards, two mechanisms were suggested in [1, 2], that logarithmically enhance the form factor asymptotics and therefore provide a qualitatively satisfactory description of the BABAR data. However, the physics of the BABAR effect was not fully clarified. Later on [3], based on a nonperturbative approach to the QCD vacuum and on rather universal assumptions, we show that there exists two asymptotic regimes for the pion transition form factor. One regime with asymptotics $F_{\pi\gamma^*\gamma}(Q^2) \sim 1/Q^2$ corresponds to the result of the standard QCD factorization approach, while other violates the standard factorization and leads to asymptotic behavior as $F_{\pi\gamma^*\gamma}(Q^2) \sim \ln(Q^2)/Q^2$. Furthermore, considering specific nonlocal chiral quark models, we find the region of parameters, where the existing CELLO, CLEO and BABAR data for the pion transition form factor are successfully described.

References

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Pion transition form factor in the Regge approach

W. Broniowski*, E. Ruiz Arriola
Jan Kochanowski University and IFJ PAN, Poland

The concept of incomplete vector-meson dominance and Regge models is applied to the transition form factor of the pion. First, we argue that the Terazawa-Wess unitarity bounds may be violated, as they follow from unverified assumptions for the real parts of the aplitudes. A direct consequence is that the transition form factor need not vanish at large Euclidean momenta. Then, we show how the BaBar data may be explained with incomplete vector-meson dominance in a model with one state, as well as in more sophisticated Regge models. Generalizations of the Regge approach result in a proper description of the data. We also consider the expermimental constraint from the $Z \to \pi_0\, \gamma$ decay. Finally, we point out that the photon momentum asymmetry parameter may strongly influence the precision analysis at large momenta.

*speaker

The Pion Electromagnetic Form Factor in the Light-Front Approach

J. Pacheco B. C. de Melo* and T. Frederico
Laboratório de Física Teórica e Computação Científica
LFTC-UNICSUL and IFT-UNESP

With the covariant light-front model LFCM, the electromagnetic pion form factor and transition form factor are calculated and compared with the new data from TJLAB and the new Babar data. Also, anothers models are discussed.

*speaker

Pion observables within the covariant formulation of Light-front dynamics

Natalia Tsirova
Université Blaise Pascal, Clermont-Ferrand, France

Within the covariant formulation of light-front dynamics, we determine the two spin components of the pion wave function in a phenomenological quark model. These spin components are further interpreted as a non-relativistic wave function and a relativistic component. This latter is determined in the one-gluon exchange approximation.

We calculate in this model several observables: the pion decay constant, the electromagnetic form factor and the transition form factor.

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Poster Section

Graviton decay to 2 photons at the LHC

Simon Dalley, Pavel Nadolsky
Southern Methodist University, USA

RESBOS, the popular program to compute QCD perturbative and resummation corrections to heavy boson production at colliders, is extended to include pp to (extra-dimensional) graviton decaying to 2 photons. More generally, the 2-photon channel is shown to have advantages for spin indentification of new boson resonances (Higgs, Z', Squarks, gravitons, etc.)

Regge behavior and exclusive processes

Felipe J. Llanes Estrada
Universidad Complutense de Madrid, Spain

Regge behavior is an outstanding feature of total hadron cross sections. I follow on some interesting features that arise when photon-induced exclusive processes are considered.

A QCD sum rule study of two scalar mesons $f_0(980)$ and $a_0(980)$

Hee-Jung Lee
Department of Physics Education,
Chungbuk National University,
Cheongju Chungbuk 361-763, South Korea

We discuss masses of the two scalar mesons $f_0(980)$ and $a_0(980)$ which are observed to have the same mass in the scalar nonets of mass less than 1GeV by using the QCD sum rules. As $f_0(600)$(or $\sigma(600)$) was analyzed in [1], the two scalar mesons are considered as the tetraquark states consisting of the scalar diquark-antidiquark and the pseudoscalar diquark-antidiquark. Based on the QCD sum rules obtained up to the operators of energy dimension 10 with instanton contributions, we analyze and discuss masses of the two scalar mesons.

References

[1] Hee-Jung Lee and N. I. Kochelev, Phys. Rev. D **78** (2008) 076005.

The study one of Proton structure function

Maryam Soleymaninia and Ali Khorramian
Semnan University, Semnan, Iran

The longitudinal nucleon structure function FL, measured in the deep inelastic lepton-nucleon scattering, is proportional to the cross section for the interaction of the longitudinally polarized virtual photon with a nucleon. The aim of this paper is to perform a QCD analysis of the longitudinal heavy and light structure functions FL(x, Q2) in the non-singlet, singlet and gluon case up to NLO. We use the light and heavy flavor Wilson coefficients and distribution functions in Mellin space.

Chiral effective field theory for nucleons in Light-Front Dynamics

Natalia Tsirova
Université Blaise Pascal, Clermont-Ferrand, France

We shall present a first attempt to formulate chiral effective field theory for nucleons within light-front dynamics. The state vector of the nucleon is defined in a covariant formulation of light-front dynamics in order to control any violation of rotational invariance. Its calculation relies on a truncation of the Fock space. We shall detail our results in a two-body Fock space truncation which includes the linear πNN interaction as well as a contact $\pi\pi NN$ coupling.