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CONFERENCE SUMMARY
ON
NEW TRENDS IN HIGH-ENERGY PHYSICS*

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Abstract

Concluding remarks on over forty papers contributed to the International Conference on New Trends in High-Energy Physics, Yalta, Crimea, Ukraine, September 22-29, 2001 are presented. Also presented are some comments on future prospects in high energy physics.

*A concluding talk to be presented at the International Conference on New Trends in High-Energy Physics, Yalta, Crimea, Ukraine, September 22-29, 2001, to be published in the Proceedings, edited by P. N. Bogolyubov and L. L. Jenkovszky (Bogolyubov Institute for Theoretical Physics, Kiev, 2001)

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I have been asked by Professor Laszlo L. Jenkovszky, the co-chairman of the Organizing Committee of this Conference, to give a conference summary together with Professor A. B. Kaidarov. Since I had prepared my contributed paper entitled, "A New Trend in High-Energy Physics", as a kind of review on the hottest subjects in high energy physics for the last couple of years [1], I have asked Professor Kaidarov to make a real summary on this Conference by covering all the papers contributed to this Conference [2] and have determined to make only some concluding remarks on this Conference as I had been asked to do for the last four in this series of Conferences [3-6]. In what follows, I shall present some concluding remarks that I have prepared but that I have missed presenting because of the shortage of time.

This International Conference on New Trends in High-Energy Physics, Yalta, Crimea, Ukraine, September 22-29, 2001 consists of six days of scientific programs including six morning and four afternoon (or night) sessions to which forty-two invited talks and two summary talks have been allocated. Let me remind you of these forty-two contributed papers one by one in the following :

On Sunday, September 23, the first part of the morning session (chaired by Professor P. N. Bogolyubov) consists of two talks. Professor L. D. Faddeev (St.-Petersburg) has given a lecture entitled, "Use of Compact Variables in Condensed Matter and Relativistic Field Theory", in which he has discussed his new way of analyzing field theoretical models such as Yang-Mills gauge theories by using the compact (gauge-like) variables [7]. I asked him, "Don't you have the Gribov ambiguities in your way of doing?". His answer was "No. I personally do not believe the ambiguities." The second lecture has been given by Professor P. Fre' (Torino) with the title, "Supersymmetric D3 Branes on Smooth ALE Manifolds with Flux" [8]. The second part of the morning session (chaired by Professor L. D. Faddeev) has only a lecture by Professor A. A. Slavnov (Moscow) with the title, "Renormalization by Enforcing a Symmetry", in which he has advocated his new way of regularization consistent with chiral fermions by demonstrating how it works in QED [9]. In answering to my question, "Can you introduce the renormalization group and Callan-Symanzik equation in your regularization?", he said, "Yes, of course." I wonder if his regularization is related to what I used in 1967 for deriving the low-energy theorem for the vacuum polarization tensors of the n-th rank in QED [10].

In the afternoon session (chaired by H. Terazawa), which seems to be devoted to field theories, five invited speakers has given their talks: "Higher Dimensional

Models with Two-Time Components" by Professor A. Sabry (Cairo) [11], "Radiatively Induced Chern-Simons Term at Finite Temperature" by O. Borisenko (Kiev) [12], "About the Landau-Pomeranchuk-Migdal Effect Suppression of High-Energy Electron's Radiation in Matter" by Professor N. F. Shulga (Kharkov) [13], "A New Canonical Treatment for a Constrained Lagrangean Systems with 'Noncanonical Gauges'" by Professor B. M. Barbashov (Dubna) [14], and "Scalar Mesons and the Glueball in SU(3) x U(3) Quark Model" by Professor M. K. Volkov (Dubna) [15].

On Monday, September 24, the first part of the morning session (chaired by Professor N. N. Nikolaev) consists of two talks. Professor J. Whitmore (DESY) has given a lecture entitled, "Elastic and Inelastic Diffractive Scattering", in which he has reviewed the HERA data on elastic and inelastic diffraction scattering [16] and presented the results of detailed analyses based on the optical, Regge, "dipole", and "resolved [17]" models. Then, Professor A. B. Kaidalov (Moscow) has given a lecture entitled, "Hard Diffraction and HERA and Tevatron", in which he has emphasized the importance of double Pomeron exchange. I have pointed out that the double Pomeron exchange would be double-counting in my picture of Pomeron as a "color-ball" consisting of an arbitrary number of gluons [18]. The second part of the morning session (chaired by Professor A. A. Slavnov) has three speakers. Professor N. N. Nikolaev (Juelich, Moscow) has given a lecture with the title, "Diffractive DIS: Where We are?", in which he has reviewed the history in details and concluded that diffraction does not require Pomeron [19]. Professor D. Schildknecht (Bielefeld) has given a lecture with the title, "Deep Inelastic Scattering at Low x", in which he advocated their old idea of "generalized vector meson dominance (GVMD) model" applicable to the deep inelastic scattering at low x [20]. I have pointed out that their GVMD model in which the virtual photon is taken as a sum of an infinite number of vector mesons and excited states seems to be equivalent to our resolved photon model [17] in which it is taken as that of quark-antiquark pair, quark-antiquark-gluon, quark-antiquark-two-gluons, and so on. Professor L. L. Jenkovsky (Kiev) has given a lecture with the title, "Duality Relation between Small- and Large-x Structure Functions", in which he has discussed the relation between the Freund-Harari duality and the Bloom-Gilman duality and concluded that the small-x and large-x are related, that the explicit models realizing the 2-dimensional duality exist, and that the Q^2 -dependence of the structure functions at small and large Q^2 are related [21].

In the afternoon session(chaired by Professor G. Abbiendi), four invited speakers have given their talks : "Off-Shell Unitarity Effects in DIS and VM Electroproduction" by Professor S. Troshin(Protvino)[22], "Spin Structure of Nucleon in QCD : Inclusive and Exclusive Processes" by Professor O. Teryaev(Dubna)[23], "Interactions at Large Distances and Properties of the Hadron Spin-Flip Amplitude" by Professor O. Selyugin(Dubna)[24], and "Search for Exotic Baryons with Hidden Strangeness in Proton Diffractive Production Processes" by Professor D. I. Patalakha(Moscow)[25]. Concerning the prediction for the cross section of $\gamma^*\gamma^*\rightarrow$ hadrons by Professor Troshin who claimed that it increases as Q^2 increases, I have strongly argued that it not only disagrees with my prediction based on the algebra of bilocal currents[26] but also the experimental data from TRISTAN[27].

On Tuesday, September 25, the first part of the morning session(chaired by J. Whitmore) consists of three talks. Professor J. Olsson(Hamburg) has given a lecture entitled, "QCD Studies at HERA", in which he has presented the detailed analysis of the H1 and ZEUS data in QCD and concluded that the NLO QCD and the DGLAP equation describe the data very well[28]. Professor R. Tenchini(CERN) has given a lecture entitled, "Test of Standard Model", in which he has reviewed in particular the tests of the gauge couplings of W , Z , and γ and stressed on the strong evidence for their triple gauge couplings[29]. Professor V. Barone(Torino) has given a lecture entitled, "Transversarity : Present and Future" [30], which seems to be very relevant as the HERMES experiment at HERA and the CLAS experiment at TJNAF are now running[31]. The second part of the morning session(chaired by Professor J. Schildknecht) has four speakers. Professor F. Constantini(Pisa) has given a lecture with the title, "New Results on Direct CP Violation", in which he has concluded that there is now good agreement on the CP violation parameter between the NA48 experiment at CERN and the KTeV experiment at Fermilab[32]. Then, Professors S. Wronka(Warszawa), P. Cenci(Perugia), and V. N. Bolotov(Moscow) have given lectures with the titles, "Results on Rare Decays" [33], "The NA48 Future Programs" [34], and "Pion and Kaon Rare Decays and the Search of a Tensor Interactions" [35], respectively.

In the afternoon session(chaired by Professor P. Cenci), two invited speakers have given their talks : "Geometrisation of Electromagnetic Field and Topological Interpretation of Quantum Mechanics Formalism" by Professor O. A. Olkhov(moscow)[36] and "EH-undulative System of 'Effective Cooling' of Electron Beams" by Professor

I. V. Gubanov(Sumy)[37], which seem difficult to understand as the former is too formal while the latter too technical.

On Wednesday, September 26, the first part of the morning session(chaired by Professor S. Wronka) consists of three talks. Professor G. DeLellis(Napolis) has given a lecture entitled, "Associated Charm Production in Neutrino Charged-Current", in which he has reported an event which is taken as the first evidence for the associated charm production in neutrino charged-current interaction[38]. Professor P. Vanlaer(Bruxelles) has given a lecture entitled, "Status Report of the CMS Experiment", in which he has concluded that the CMS at LHC will cover the whole mass range of the Higgs scalar[39]. Professor G. Abbiendi(Bologna) has given a lecture entitled, "Tests of the Standard Model and Constraints on New Physics from Fermion-Pair Production at LEP2", in which he has concluded no evidence for new physics[40]. However, I wish to emphasize that the CDF and HERA anomalies may still indicate the possible existence of either leptoquark and/or excited positron whose mass is around 300-400GeV[1]. The second part of the morning session(chaired by Professor P. Vanlaer) has three speakers Professor D. Bailey(Bristol) has given a lecture with the title, "Heavy Flavour Production at HERA", in which he has concluded that HERA has produced a wealth of information on heavy quarks[41]. Professor R. Tenchini(CERN) has given a lecture with the title, "Search for the Higgs Boson", in which he has concluded that the ALEPH sees the Higgs candidates at 115.6GeV with the statistics of 3.1σ while the OPAL, L3, and DELPHI have only the statistics of 1.2σ , 1.1σ , and background level, respectively[42]. Professor C. E. Pagliarone(Cassino) has given a lecture with the title, "Beyond the Standard Model: An Experimental Overview", in which he has discussed the possible virtual graviton effect, real graviton emission, and black hole production at LEP, HERA, Tevatron, and future colliders[43]. I have pointed out that listening to the noise in the LIGO and VIRGO interferometers for gravitational waves may already exclude the possible extra-dimensions as small as a string length($\sim 10^{-32}$ cm) according to the recent suggestion by Amelino-Camelia[44].

In the afternoon session(chaired by Professor N. A. Russakovich), four invited speakers have given their talks: "Exclusive and Inclusive Diffraction at HERA" by Professor J. Whitmore(DESY)[45], "Odderon Search with H1 Detector at HERA" by Professor J. Olsson(Hamburg)[46], "The BESS Model in CMS" by Professor M. Spezniga(Texas)[47], and "A New Trend in High-Energy physics-Current Topics in Nuclear and Particle Physics" by myself[1].

On Thursday, September 27, the first part of the morning session(chaired by R. Tenchini) consists of three talks. Professor M. Kotsky(Calabria) has given a lecture entitled, "NLO Impact Factors" [48]. Professor V. I. Kuvshinov(Minsk) has given a lecture entitled, "Order to Chaos Transition in Yang-Mills-Higgs Field System", in which he has concluded that the pure Yang-Mills system is totally chaotic but that a Higgs field regularizes the system[49]. Then, Professor V Magas(Bergen, Kiev) has given a lecture entitled, "Three Module Model for Ultra-Relativistic Heavy Ion Collisions" [50]. The second part of the morning session(chaired by G. DeLellis) has four speakers. Professor N. G. Fadeev(Dubna) has given a lecture with the title, "On the Possibility of the Inertia Coordinate Transformation Based on the Lobachevski Function" [51]. Professor M. Tasevsky(CERN) has given a lecture with the title, "Results from LEP concerning Differences between Quarks and Gluons" [52]. Professor Yu. Shutunov(Kiev) has given a lecture with the title, "Principles of the Brane-World Theory", in which he has discussed an extension of the Einstein-Friedmann cosmological equation in the "brane-world theory" [53]. I have simply pointed out that such extension is known in any pregeometric or induced gravity theories reproducing Einstein theory of gravity at low energies[54]. Then, Professor D. Bernard(Palaiseau) has given a lecture with the title, "On the Recent BaBar Results", which has reported the first evidence for CP violation in the neutral B meson system[55] and which has received a comment insisting that the Belle result shows an even clearer evidence with five standard deviations[56]

To sum up, I wish to conclude that I have found this Conference the most successful not only with so many fresh and intriguing experimental and theoretical contributions but also with so many excursions almost every day. I hope that the next Crimean Conference in this series to be held in late May, 2003 will be as successful as this. Concerning future prospects of high energy physics, I have recently presented many discussions in various conferences including the last Crimean Conference[6]. Instead of repeating these discussions, I wish to present my personal small comment in the following: One of the latest exciting news in Japan is that Professor Ryoji Noyori will eventually receive Nobel Prize in chemistry this year for his invention of the method of producing the left-handed or right-handed molecule separately which was made over three decades ago. However, the reason why only one of the left- and right-handed one exists in living-things on Earth (or in the Universe) is still unknown. Remember that the late Professor A. Salam had been trying to explain

it in the standard model[67]. It is a kind of "astroparticle biology". I expect that high energy physics (or particle physics), which is now moving toward astroparticle physics, will eventually develop into astroparticle biology in the future. In any case, we can expect that sciences and technologies would survive and/or revive through this century thanks to such discoveries and/or inventions as long as we have curiosity.

In conclusion, let us remind you of the historical fact that the famous "Yalta Conference", which was held at the place close from here in 1945 for ending the World War II and for bringing peace to the world, had erroneously brought the "Cold War" between the "East" and the "West" due to the different ideologies existing in the latter half of the last century. I hope that this series of "Yalta Conferences" will bring us a "New Peace" in spite of the different philosophies still existing in the world of the twenty-first century, instead of the "New War" which all of us have been afraid of since the horrible terrors happened in New York City and Washington D. C. on September 11, 2001.

As the last speaker from outside of the countries organising this Conference, Ukraine and Russia, on behalf of all the foreign participants, I would like to thank Professor P. N. Bogolyubov, Professor L. L. Jenkovszky, and all the other organizers for their inviting us to this Conference and for their perfect organization. At last but not in the least, I also wish to thank not only Dr. V. Magas, Dr. Yu. Shtanov, and the other scientific secretaries but also Ms. Olga Ugrumova and the other secretaries for their many useful helps with which we have enjoyed our one week stay at Kiev, Simferopol, and Yalta in the beautiful country of Ukraine.

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