XXIX-th International Workshop on High Energy Physics: NEW RESULTS and ACTUAL PROBLEMS in PARTICLE & ASTROPARTICLE PHYSICS and COSMOLOGY

Wednesday 26 June 2013 - Friday 28 June 2013

IHEP, Theoretical Division

Book of Abstracts

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Opening address

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Overview of the Higgs boson searches at the LHC

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Higgs studies at the Tevatron

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Higgs at Least

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On possible interpretation of the LHC Higgs-like state in the framework of the non-perturbative effective interaction of W bosons

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The Higgs, a Higgs or Higgs-like alternatives?

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Panel Discussion on Higgs Boson

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Moderator:
V. Kiselev
Panelists:
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F. Riva

Questions:
• If the SM with elementary Higgs field is completely confirmed with the discovery of a heavy scalar boson at LHC and Tevatron?
• Does the Higgs mass value of 126 GeV point to the need of new physics below the Planck scale?
• Do we need the next Higgs factory to solve problems with its identification?
• How can we distinguish extended Higgs sector from the standard one as well as from the composite Higgs?

Evening session / 7

Review of the physics of Quark Gluon Plasma

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Recent Results on Heavy Ions at RHIC

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Quark-gluon plasma, challenges to theory

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Recent results from the LHCb experiment

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Searches for Supersymmetry at CMS

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Exotica, Beyond Two Generations

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Panel Discussion on QGP, Heavy Quarks and Exotics

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Moderator:
V. Zakharov
Panelists:
S. Kabana
O. Evdokimov
K. Kotov
S. Troshin
S. Sadovsky

Questions:
• In which case experiment could unambiguously (dis)prove the existence of Quark-Gluon Plasma?
• If the investigations of HI collisions can clarify the confinement problem?
• Is there time enough for establishing the local thermodynamic equilibrium in the course of the HI collision?
• Can HI collisions imitate the early instants of the Universe evolution?

Evening session / 15

Charge Particle Production at HERA

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Quark-gluon plasma multiplicity from AdS spaces modifications

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In holographic approach the Quark Gluon Plasma (QGP) formation in 4D
space is related with Black Hole (BH) creation in 5D Anti de Sitter space (AdS) and multiplicity in heavy-ion collisions is determined by entropy of 5D BH. Using the general relativity technique the entropy of formed BH can be estimate by the trapped surface area. We simulate energy dependence of entropy considering modifications to AdS by different wrapping factors. We compare the results with experimental data.

Morning session / 20

OPERA experiment

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This talk is focused on a general description of the OPERA experiment, which is designed to observe directly the appearance of nu-tau produced by neutrino oscillations in an almost pure nu_mu beam. The neutrino beam is produced at CERN and detected 730 km away in an underground hall of the National Laboratory of Gran Sasso.
OPERA detector is a hybrid structure, containing nuclear emulsion detector modules with lead plates, acting as a target for the neutrino beam, complemented by electronic target trackers and muon spectrometers.
The signature of a tau neutrino interaction is the observation of the tau lepton decay and the absence of muon at the primary vertex.
To obtain information about the charged particles trajectories around the interaction vertex, the emulsion is scanned with automatic scanning systems.
The current status of data taking is reported.
The main background sources having the nu_tau event topology include the reinteraction of hadrons, the decay of charmed mesons produced in nu_mu Charged Current interaction, and the scattering of muons from nu_mu Charged Current interactions.
In this talk the estimated level of background events is reported and the results of the nu_mu->nu_tau analysis are presented.

Morning session / 21

Super-Kamiokande Results

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Morning session / 22

Status and results of the GERDA experiment

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The study of neutrinoless double beta decay ($0\nu\beta\beta$) is a powerful approach to investigate fundamental properties of neutrinos. The observation of $0\nu\beta\beta$ would demonstrate lepton number violation in nature and prove that neutrinos have a Majorana component. It will also give an access to the neutrino mass hierarchy and to the information on the absolute values of the neutrino masses. The {\sc Gerda} experiment [1] is an low background experiment aimed to search for the $0\nu\beta\beta$ of ^{76}Ge. The aim of {\sc Gerda} is to test the claim of discovery by part of Heidelberg-Moscow Collaboration [2], and, in a second phase, to achieve much better sensitivity than recent experiments. The main concept of {\sc Gerda} is the operation of naked HPGe detectors made from enriched ^{76}Ge, which are immersed in liquid argon (LAr). A cryostat with 64˜m^3 liquid argon is located inside a steel tank containing 590˜m^3 pure water. Presently in Phase˜I, eight detectors of coaxial type made from material enriched in ^{76}Ge are deployed. Detectors are mounted on low mass holders and read out by custom made, low radioactive amplifiers located close to the diodes. A background index of about 2×10^{-2} cts/(keV·kg·yr) is reached near the region of $0\nu\beta\beta$ search. Obtained half-life of two-neutrino double beta decay of ^{76}Ge is $(1.84$
$substack{+0.14 - 0.10})\times10^{21}$ yr [3]. Currently an exposure more than 20 kg·yr has been accumulated in {\sc Gerda} experiment since November 2011. In June 2013 it is planning to stop data taking and open narrow blinded region of the expected $0\nu\beta\beta$ peak location. \\
At the same time preparations towards the second phase of {\sc Gerda} are ongoing. New enriched BEGe detectors with total mass of about 20 kg were successfully produced and tested. They show good resolution and pulse shape discrimination capability. Operations for the deployment of these detectors together with LAr light scintillation veto in {\sc Gerda} is planned to start just after the finishing of the Phase I data taking. We are expecting that such improvements allow us to suppress backgrounds in {\sc Gerda} to the level of 1×10^{-3} cts/(keV·kg·yr) in the region of interest.

[1] H.-K.Ackermann et al., Eur. Phys. J. C 73 (2013) 2330.
[2] H.V. Klapdor-Kleingrothaus et al., Phys. Lett. B586, 198 (2004).
[3] M.Agostini et al., J. Phys. G: Nucl. Part. Phys. 40 (2013) 035110.

Morning session / 23

Neutrino oscillations: recent results and perspectives

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Morning session / 24

Panel discussion on Neutrino Problems

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Moderator:
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Panelists:
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M. Khabibullin
N. Titov
S. Gershtein

Questions:
• How well do we need to know the standard neutrino sector parameters?

• Neutrino and the lepton/baryon asymmetry in the Universe.
• Are there new species of neutrino (e.g. the "sterile"one)?
• What are the most important problems of neutrino physics?
• Perspectives of neutrino experiments.

Evening session / 25

SM and QCD Results at the LHC

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What Do We Learn about Strong Interactions from Experiments at High Energies?

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Spin Results at RHIC

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Inward Horizons of the Spinning Nucleons

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Panel discussion on SM&QCD at High Energies and Nucleon Structure

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Moderator:
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Panelists:
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Questions:
Panel Discussion IV.
• Does QCD help us to understand strong interactions?
• Does the SM theory with Kobayashi-Maskawa (CKM) quark-mixing matrix describe all CP-violation and rare decays phenomena observed in the heavy quark sector?
• Can quantum loop corrections reveal new physics mass scales well above the TeV scale, by means of indirect searches?
• Is the low-energy supersymmetry of TeV scale in trouble after the LHC results on its direct search?

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CONCERT

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Black Holes in Binary Systems ang Galaxy Nuclei

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Supermassive Black Hole at the Galactic Center

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Morning session / 38

Einsteinian revolution's misinterpretation: no true black holes, no information paradox, but just quasi-static balls of quark gluon plasma'

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Even if one would assume existence of Black Holes (BHs), High Energy Astrophysics observations cannot be explained because no free charge, no current can emerge from central singularities. In other words, even supposed charged BHs cannot have any electromagnetic property. In fact gravitational effects too should not propagate out of Event Horizons! Several authors try to resolve the BH conundrum by invoking the original Schwarzschild solution for a Point Mass"by assuming the integration constant α¬¬¬¬ to be finite. But this approach is inconsistent because it endows aPoint Mass"with a surface area of 4πα¬¬¬ 2. This problem was finally resolved by Mitra (J. Math. Phys. 2009) by showing that, for a Point Mass", α=0. Mathematically this implies that BHs have unique gravitational mass M=0. Physically, for continued gravitational collapse the entire mass energy must be radiated out. Since the comoving proper time for formation of a M=0 BH is infinite, such a singular state is never formed and the so-called BH Candidates must beEternally Collapsing Objects"(ECO). As the collapsing object heats up by contraction and start trapping its own radiation, at a certain stage, it attains "Eddington Luminosity"when the inward pull of gravity gets balanced

by outward radiation force. Astrophysical ECOs are expected to be strongly magnetized (MECOs), and there are many evidences that whether in X-ray binaries or in Quasars, the BH Candidates are MECOs. The magneto radiative instabilities of MECO plasma cause unpredictable Solar Flare and Coronal Mass Ejection like phenomena. The long duration Gamma Ray Bursts are associated with formation of nascent MECOs and rejuvenation of their central engines can be understood as further collapse of unstable nascent MECOs.

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Theoretical Flaws in Black Hole Theory and General Relativity

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All alleged black hole solutions pertain to a universe that is spatially infinite, is eternal, contains only one mass, is not expanding, and is asymptotically flat. But the alleged big bang cosmology pertains to a universe that is spatially finite, is of finite age, contains radiation and many masses including multiple black holes (some of which are primordial), is expanding, and is not asymptotically flat. Thus the black hole and the big bang contradict one another –they are mutually exclusive. The black hole is almost universally claimed to be predicted by General Relativity. It is surprisingly easy to prove that this is not true. Similarly it is very often claimed that Newton's theory of gravitation also predicts the black hole, but this too is very easily proven to be erroneous. Despite numerous claims for discovery of black holes in their millions, nobody has ever actually found one. In addition it is not very difficult to prove that General Relativity violates the usual conservation of energy and momentum, with only a little use of mathematics. The simple proofs also demonstrate that all 'singularity theorems'related to General Relativity are invalid. Fundamentally there are contradictions contained in the very physical principles of General Relativity, combined with invalid mathematics, which render the theory untenable. It is the object of this paper to provide the proofs without the complicated mathematics usually associated with the subject.

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Panel discussion on Black Holes

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Moderator:
S. Sokolov
Panelists:
A. Cherepashchuk
A. Mitra
S. Crothers
A. Zakharov

Questions:
• Is there a definitive observational/experimental proof of the existence of black holes?
• Are there theoretical problems with black holes?
• Are any understanding of mass gap between the supermassive black holes in centers of spiral galaxies and star-range black holes ascribed to probable candidates?
• Do we need to get primordial black holes from the first times?

Evening session / 41

Einsteinian revolution's wrong turn: lumpy interacting cosmos assumed as smooth perfect fluid: no dark energy

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Newtonian Cosmology was apparently plagued with the problem of infinite gravitational force, and Einstein's General Relativity apparently ushered in the revolutionary concept of a closed finite non-singular static universe. Later, Big Bang model (BBM) essentially incorporated non-static versions of similar relativistic model. Simultaneously the concept of a Cosmological Constant or a repulsive vacuum energy density got incorporated by either for Inflation or for Dark Energy. We dismantle this nearly century old edifice by presenting several exact proofs showing that Cosmological Constant or Dark Energy is non-existent, and Einstein's Static universe is just the Minkowski vacuum. By using the just found Schwarzschild form of the FRW metric (Mitra, Grav. Cosmo. 2013), we show that FRW metric too is actually the Minkowski vacuum! It is suggested that physical universe is quasi-Newtonian where for any given galaxy, finite gravitational potential is due to interaction of nearest neighbors while the infinite background forces cancel one another due to symmetry. Such an universe is likely to have a fractal structure as suggested by observations. The cosmic redshift might arise due to asymmetric spread of wave packets associated with line emissions from distant galaxies. The cosmic background radiation might be due to thermalization of star lights in an eternal universe as suggested by Hoyle, or it might be superposition of gravitationally redshifted quiescent Eternally Collapsing Objects", the supposed "Black Hole Candidates". The atmosphere of hot ECOs may synthesize not only light elements but infuse fresh hydrogen from flares of ECO plasma.

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The gamma-ray bursts, core-collapse supernovae and global star forming rate at large redshifts

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The brief review and discussion of statement of some observational problems of gamma-ray bursts (GRB), GRB host galaxies and star forming at small and large redshifts: Are there similarities and differences between GRB hosts and the typical galaxy population - this is currently the main question for the study of GRB host galaxies. The direct connection between long-duration GRBs and massive stars explosions, GRBs and some puzzles of core-collapse supernovae are discussed. On model-independent observational cosmological tests - GRB rate and star forming rate at high redshifts.

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On Semiclassical Quantum Cosmology becoming a numerical subject

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High Energy Gravitational Waves from the Early Universe

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Cosmological perturbations: what do they tell?

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Panel discussion on Cosmology

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Moderator:
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Panelists:
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V. Rubakov
A. Dolgov
S. Crothers
A. Zakharov

Questions:
Discussion VI.
• To what extent Dark Matter and Dark Energy are necessary to explain the observed properties of the Universe?
• Why the Dark matter profiles so universal at the galactic scales?
• Are there viable candidates of modified gravitational dynamics to exclude the dark components of Universe?
• Have we any perspectives to distinguish the Dark Energy from the cosmological constant?
• Are there any certain indications for the sterile neutrinos in the cosmos?
• How does the Planck data change the view to the inflation of early Universe? What is an origin of inflaton plateau? So far, what else is interesting about the Planck data?
• What are nearest crucial points in cosmological observations?
• Can we be more decisive discriminating between anthropic principle, super-stringy landscape, fine tuning or dynamics as concerns for the cosmological coincidences?

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Closing address

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Morning session / 52

Point massive particle in General Relativity

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It is well known that the Schwarzschild solution describes the gravitational field outside compact spherically symmetric mass distribution in General Relativity. In particular, it describes the gravitational field outside a point particle. Nevertheless, what is the exact solution of Einstein's equations with \delta-type source corresponding to a point particle is not known. In the present paper, we prove that the Schwarzschild solution in isotropic coordinates is the asymptotically flat static spherically symmetric solution of Einstein's equations with \delta-type energy-momentum tensor corresponding to a point particle. Solution of Einstein's equations is understood in the generalized sense after integration with a test function. Metric components are locally summable functions for which nonlinear Einstein's equations are mathematically defined. The Schwarzschild solution in isotropic coordinates is locally isometric to the Schwarzschild solution in Schwarzschild coordinates but differs essentially globally. It is topologically trivial neglecting the world line of a point particle. Gravity attraction at large distances is replaced by repulsion at the particle neighborhood.

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KATRIN Experiment: status and perspectives 2013

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KATRIN project has a goal to set electron antineutrino mass upper limit at 0.2 eV level. Installation construction at Karlsruhe Institute of Technology (KIT) proceeds to it final stage. Inner electrodes are installed inside the main spectrometer and first background tests are launched. Windowless gaseous tritium source (WGTS) temperature stabilization was proven to provide 20 mK temperature uniformity. WGTS superconducting coils are under construction. INR RAS participates in the Rear Wall subproject. RW should control gaseous tritium electric potential uniformity inside WGTS via plasma generated by tritium beta-electrons. Set of experimental test is planned at INR "Troitsk numass"spectrometer.

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Search for the U boson in WASA@COSY experiment

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What can we learn from nuclei-nuclei interactions at LHC

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The discovery of Higgs boson completed the first (and main) stage of experiments on p-p-interactions at LHC. Attempts to search new physics effects in these experiments did not give positive results. At that time, many interesting and not described by modern theories and models phenomena were observed in cosmic ray experiments in the energy region 1015 –1017 eV, which corresponds to the

LHC energy interval 1 −14 TeV. It is important that all unusual phenomena were observed in interactions of cosmic ray particles (most part, nuclei) with nuclei of atoms of the atmosphere. In this talk, on the basis of the analysis of cosmic ray experimental results, some propositions for nuclei-nuclei experiments at LHC are considered.

Morning session / 64

Search for neutrino oscillations in appearance mode with the OPERA experiment

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The present talk highlights the data analysis status of the OPERA experiment. The experiment exploited the CNGS beam from CERN to Gran Sasso, at the average L/E ratio of 43 km/GeV, optimized to search for ν_μ→ν_τ oscillation in appearance mode, and also allowing to perform a ν_e appearance search. Profiting of the sub-micrometer spatial resolution of nuclear emulsions, employed in the OPERA experiment, it is possible to identify and analyze the neutrino interactions on event-by-event basis.
The hardware of the experiment as well as the status of emulsion scanning are described in the other OPERA presentation by Andrey Sheshukov. In this talk we review the data simulation and the analysis chains, with an emphasis on what was done during the last year. The main kinematical parameters of the neutrino event are introduced; we specially discuss the parameters sensitive to the neutrino flavor. The uncertainties on the event parameter estimation are reviewed, and the main sources of background for the ν_μ→ν_τ oscillation search are examined. The topologies of the three observed ν_τ candidate events are discussed.
The status of the ν_e appearance search is also reviewed, the ν_e identification technique and the main sources of relevant background are briefly discussed. Finally, we present the constraints set by the OPERA experiment on the mixing angle θ_13 and on the LSND/MiniBooNE anomaly.

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PHOTOES