Time and Matter 2010

Report of Contributions

Contribution ID: **0** Type: **not specified**

Welcome and Opening Lecture

Monday 4 October 2010 10:00 (30 minutes)

Session Classification: Welcome and Opening Lecture

Contribution ID: **1** Type: **not specified**

Search for solar axions with the CAST experiment

Monday 4 October 2010 11:00 (1 hour)

Axions are hypothetical particles arising in models which may solve the CP problem of strong interactions. They are practically stable neutral pseudoscalar particles and also viable candidates for the dark matter in the universe.
Most of the axion experimental searches are based on the axion coupling to two photons. As a consequence of this coupling, axion could transform into photon and vice versa in external electric and magnetic fields. Axions could be produced in the solar core by converting thermal photons in the Coulomb fields of nuclei and electrons - the Primakoff process, and back-converted into photons in a laboratory magnetic field.
CERN Axion Solar Telescope (CAST) is designed to search for these axions by using a Large Hadron Collider prototype dipole magnet which follows the Sun during sunrise and sunset throughout the year. To explore as wide as possible range of axion masses, the operation of CAST is divided in two phases. During the phase I the experiment operated with vacuum inside the magnet bores and covered axion masses up to 0.02 eV. In order to extend the sensitivity to higher axion masses, the magnet bores are filled with a buffer gas at various densities. In the first part of the CAST phase II, 4He was used as a buffer gas.
In the ongoing second part of the phase II, CAST has been using 3He to cover axion masses up to 1 eV. So far, no evidence of axion signal has been found and CAST set the most stringent experimental limit on the axion-photon coupling constant over a broad range of axion masses.

Primary author: Prof. LAKITCH, Biljana (Rudjer Boskovic Institute, Zagreb, Croatia)

Presenter: Dr LAKIC, Biljana (Rudjer Boskovic Institute, Zagreb, Croatia)

Session Classification: Matter and Dark Matter

Contribution ID: **2** Type: **not specified**

Prospects for Understanding the Nature of Matter with the ATLAS Detector

Monday 4 October 2010 14:30 (30 minutes)

I will present the prospects of understanding the nature of matter by searching for the Higgs boson, Super-symmetry and Beyond Standard Model physics at ATLAS.

Presenter: Prof. KERSEVAN, Borut Paul (Jozef Stefan Institute, Ljubljana, Slovenia)

Session Classification: Matter and Dark Matter

Contribution ID: **3** Type: **not specified**

Overview of the recent physics results from CMS

Monday 4 October 2010 15:00 (30 minutes)

Since Spring 2010 the CMS experiment has recorded about 3 pb-1 of proton-proton collision data at a centre-of-mass energy of 7 TeV, and a substantial increase is expected until the end of the year. In this talk first results on Standard Model physics obtained in this new energy domain will be presented, demonstrating the outstanding performance of the CMS detector. First examples of BSM search results will be given and the preparation for a wider range of searches will be discussed.

Presenter: Prof. ADAM, Wolfgang (Institute of High Energy Physics, Austrian Academy of Sciences, Vienna, Austria)

Session Classification: Matter and Dark Matter

Contribution ID: **4** Type: **not specified**

LHCb

Monday 4 October 2010 16:00 (30 minutes)

Presenter: Prof. LEFEVRE, Regis (Laboratoire de Physique Corpusculaire, Université Blaise Pascal, France)

Session Classification: Matter and Dark Matter

Contribution ID: **5** Type: **not specified**

Causality and Signal Propagation - Plenary

Presenter: FRITSCH, Mathias (University of Maryland)

Contribution ID: **6** Type: **not specified**

Strings and locality

Presenter: ALVAREZ, Ezequiel (University of Brasilia..)

Contribution ID: **7** Type: **not specified**

TBA - Coherence, Decoherence, Entanglement..

Presenter: Prof. UFFINK, Jos (Utrecht Universiteit, Nederlands)

Contribution ID: **9** Type: **not specified**

The qubits and the equations of physics

Thursday 7 October 2010 15:45 (30 minutes)

Here I show that a classical or a quantum bit state plus one simple operation, a flipping action, are sufficient ingredients to derive a quantum dynamical equation that rules the sequential changes of the state. Uniformity of time arises due to the composition rule of the actions. Then, by assuming that a freely moving massive particle is the qubit carrier, it is found that both, the particle evolution in physical space and the qubit state, change in time according to the Pauli-Schrödinger equation. This approach suggests the following conjecture: because it carries one qubit of information the particle motion in 3D space has its description enslaved by the very existence of the internal degree of freedom. It is compelled to be no more described classically
(Hamilton equation) but by a wavefunction. I also briefly discuss the Dirac equation in terms of qubits.

Presenter: Prof. MIZRAHI, Salomon (Universidade Federal de Sao Carlos, Brasil)

Session Classification: Coherence, Decoherence, Entanglement

Contribution ID: **10** Type: **not specified**

CP Violation in B Meson Decays - Present and Future

Wednesday 6 October 2010 09:30 (1 hour)

The talk will review some highlights of measurements of B and D meson properties in experiments at B factories, with emphasis on the time evolution of the systems and CP violation. We will further discuss the motivation for a future Super B factory, as well as the requirements for the detector and for the accelerator. Finally, the present status of the project will be presented together with the plans for the future.

Presenter: Prof. KRIZAN, Peter (Josef-Stefan Institute, Slovenia. Belle, Japan.)

Session Classification: CP and CPT Violation

Contribution ID: **11** Type: **not specified**

Improved search for the neutron electric dipole moment

Wednesday 6 October 2010 11:30 (30 minutes)

One of the mysteries of our universe is the observed baryon asymmetry which can not be explained using the Standard Model of particle physics. According to Sacharov this implies further, yet unknown, CP violation which will be tested with a refined search for the neutron electric dipole moment. A collaboration of 15 European institutes has been preparing a more sensitive experiment to be operated at the Paul Scherrer Institut, based on the former RAL/Sussex/ILL. In a first step the sensitivity shall be improved to dn<5×10-27 e*cm to be compared with the present experimental limit of dn<2.9×10-26 e*cm. This will be achieved by significantly increased ultracold neutron densities and an according control of systematic effects. In parallel a completely new apparatus is being developed which will push the sensitivity well into the 10-28 e*cm range.

Presenter: Prof. SCHMIDT-WELLENBURG, Phillip (Paul Scherrer Institute, Switzerland)

Session Classification: CP and CPT Violation

Contribution ID: **12** Type: **not specified**

The Pierre Auger Observatory : latest results and prospects for hunting non-perturbative physics

Tuesday 5 October 2010 16:30 (30 minutes)

The Pierre Auger Observatory was designed to make precise measurements of cosmic ray air showers induced by the highest energy cosmic particles. The aparatus consists of about 1600 water Cherenkov tanks distributed over an area of some 3000 square kilometers, all of which are overlooked by 24 fluorescence telescopes. The instrument has already provided us with the most detailed energy spectrum measurement at the highest energies, information on the primary composition, and hints of ansisotropy in the arrival directions of the highest energy events. The aparatus provides a means to study not only hadron and photon induced showers, but also the showers which may be produced by untrahigh energy neutrinos interacting in the atmosphere or in the Earth. Interestingly, it may be possible to uncover non-perturbative physics by comparing the rate of nearly horizontal showers generated by deeply penetrating neutrinos to that of up-going showers produced by neutrinos skimming the Earth's surface. Though the techique is agnostic regarding the hypothetical physics underpinning such signatures, an observation could have bearing on our picture of how the baryon asymmetry of the universe was created.

Presenter: PAUL, Tom (Northeastern University, USA)

Session Classification: The Universe - from the Big Bang to the Present

Contribution ID: **13** Type: **not specified**

Measurement of Direct CP Violation, CPT Symmetry from the KteV Experiment

Wednesday 6 October 2010 11:00 (30 minutes)

Precise measurements of CP and CPT symmetry based on the full dataset of K -> pi pi decays collected by the KTeV experiment at Fermi National Accelerator Laboratory during 1996, 1997, and 1999 are presented. The direct CP violation parameter Real(epsilon'/epsilon) is determined to 10% accuracy: Real(epsilon'/epsilon)=(19.2 \pm 2.1)x10^{-4}. Several parameters that test CPT invariance are measured as well. We find the phase of the indirect CP violation parameter epsilon, \phi_{\epsilon}~=~(44.09 \pm 1.00). We measure the difference of the relative phases between the CP violating and CP conserving decay amplitudes for K to pi^+ pi^- and for K to pi^0pi^0, \delta\phi = (0.29 $\pm$ 0.31). From these phase measurements, we place a limit on the mass difference between K_0 and \bar{K_0} mesons, \Delta M < 4.7x10^{-19} GeV at 95% C.L. These results are consistent with those of other experiments, our own earlier measurements, and CPT symmetry.

Presenter: Prof. GLAZOV, Alexander (DESY, Germany)

Session Classification: CP and CPT Violation

Contribution ID: **14** Type: **not specified**

Quantum Gravity & String Theory: A Status Report

Thursday 7 October 2010 09:30 (1 hour)

Part I: Introduction to Quantum Gravity (Why? What? How?)

Part II: Status of String Theory as a Theory of Quantum Gravity
(Achievements and Shortcomings. Outlook)

Presenter: Prof. BLAU, Matthias (University of Bern, Switzerland)

Session Classification: Old and New Paradigms in Quantum Gravity

Contribution ID: **15** Type: **not specified**

N=8 supergravity: an update

Thursday 7 October 2010 14:30 (45 minutes)

Very recent work has revealed unexpected finiteness properties of N=8 supergravity, the maximally extended supersymmetric extension of Einstein's theory in four space-time dimensions. In this talk I will try to review these exciting developments at an introductory level.

Presenter: Prof. NICOLAI, Hermann (Max Planck Institut fur Gravitationsphysik, Potsdam, Germany.)

Session Classification: Old and New Paradigms in Quantum Gravity

Contribution ID: **16** Type: **not specified**

Looking through the black hole horizon in AdS/CFT

Thursday 7 October 2010 11:00 (30 minutes)

We study a holographic description of the region behind a black hole horizon using the AdS/CFT correspondence. In particular we discuss the relationship between gauge theory observables adapted to external and infalling bulk observers, and the relationship between physics near the horizon and near the singularity Using D-brane probes we find some sharp signatures of the singularity. (Based in part on arXiv:0904.3922 and on ongoing work in collaboration with G. Horowitz, S. Shenker, and E. Silverstein).

Presenter: Prof. LAWRENCE, Albion (Brandeis University, USA)

Session Classification: Old and New Paradigms in Quantum Gravity

Contribution ID: **17** Type: **not specified**

Large Field Inflation, Ignobly

Thursday 7 October 2010 11:30 (30 minutes)

We explore in detail inflationary models where the inflaton is an axion whose potential is generated by the mixing with topological 4-forms. The mixing-generated inflaton mass term is radiatively protected by a shift symmetry, that is only broken weakly by nonperturbative effects and/or background flux values. Such mechanisms are very similar to monodromy inflation, and may naturally emerge from dimensional reductions of supergravity theories with form fields and Chern-Simons couplings. So it is very interesting to seek a precise embedding of such dynamics in string theory. We perform a detailed analysis of various possible sources of quantum corrections to the leading order inflationary potential, and find the conditions that the model constructions must obey to yield phenomenologically viable scenarios. They may be possible to
realize in some corners of the string landscape. Finally we outline possible signatures, which can be accessible to future cosmological observations.

Presenter: Prof. KALOPER, Nemanja (University of California, Davis, USA)

Session Classification: Old and New Paradigms in Quantum Gravity

Contribution ID: **18** Type: **not specified**

Exploring the primordial Universe with CMB polarization

Tuesday 5 October 2010 09:30 (1 hour)

Observations of the Cosmic Microwave Background anisotropies have led over the last decade to spectacular results concerning the cosmological model describing our Universe. The specific angular scales of the temperature and polarization anisotropies, along with other cosmological probes, have allowed for an accurate measurement of the cosmological parameters leading to the LambdaCDM model. All observations are consistent with scale-invariant adiabatic primordial perturbations, a prediction of the inflationary paradigm that would also solve other issues concerning the primordial Universe.
A direct evidence for inflation would be the detection of so-called B-mode CMB polarization anisotropies, related to tensor perturbations of the metric (primordial gravitational waves) naturally produced by inflation. The level of these B-modes (characterized by the tensor-to-scalar ratio r) is directly related to the energy scale of inflation while the spectral index of these fluctuations, along with that of scalar perturbations and r would allow for efficient selection and consistency tests among the many inflationary models.
Although r is expected to be small (the present limit is $r < 0.25$ at 95% C.L.) the quest for B-mode polarization in the CMB has started and many collaborations are now tackling this challenging task from ground, balloons or space.

Presenter: Prof. HAMILTON, Jean-Christophe (University of Paris 7)

Session Classification: The Universe - from the Big Bang to the Present

Contribution ID: **19** Type: **not specified**

Spacetime foam, holographic cosmology and MoNDian dark matter

Tuesday 5 October 2010 15:00 (30 minutes)

Probed at small scales, spacetime appears to be very complicated - something akin in complexity to a turbulent froth which John Wheeler dubbed spacetime foam. I will give an elementary discussion of my recent work on spacetime foam and the cosmology (dark energy and dark matter) inspired by it.

Presenter: Prof. NG, Y. Jack (University of North Carolina, USA)

Session Classification: The Universe - from the Big Bang to the present

Contribution ID: **20** Type: **not specified**

Asymptotic safety

Tuesday 5 October 2010 14:30 (30 minutes)

After introducing the notion of asymptotic safety I will briefly discuss the existing theoretical evidence for this behavior in the case of gravity, and possible appplications to inflationary cosmology.

Presenter: Dr PERCACCI, Roberto (SISSA, Italy)

Session Classification: The Universe - from the Big Bang to the present

Contribution ID: **21** Type: **not specified**

QUIET Experiment - Ground-based probe of CMB Polarization

Tuesday 5 October 2010 11:00 (30 minutes)

The Q/U Imaging ExperimenT (QUIET) is a ground-based radiometer array
designed to measure the polarization of the Cosmic Microwave Background (CMB)
radiation. The polarization of the CMB can be decomposed into a curl-free component, or E-modes, and divergence-free component, or B-modes. Previous observations for the E-modes as well as temperature anisotropy of the CMB have been used to constrain the cosmological parameters that model the history of our universe. On the other hand, the B-modes are uniquely sensitive to primordial gravity waves from the inflationary epoch. The B-modes have not been observed yet. QUIET and other current and future experiments are aiming for the detection of the inflationary B-modes.
In this presentation, I will talk about the instrumentation, observation strategy as well as the current status of the analysis, and discuss about future upgrade of QUIET.

Presenter: Prof. TAJIMA, Osamu (KEK, IPNS, Japan)

Session Classification: The Universe - from the Big Bang to the Present

Contribution ID: **22** Type: **not specified**

Model independent constraints from the CMB

Tuesday 5 October 2010 11:30 (30 minutes)

We analyse CMB data in a manner which is as model-independent as possible.
We encode the effects of late-time cosmology into a single parameter which
describes the distance to the last scattering surface, similar to the shift parameter, and exclude low multipoles, up to l 40 from the analysis. We consider the WMAP five-year as well as ACBAR 2008 observations. We obtain constraints on parameters which can be applied as priors in other analysis without committing to a specific model of the late universe.

Presenter: Dr VONLANTHEN, Marc (University of Geneva, Switzerland)

Session Classification: The Universe - from the Big Bang to the Present

Contribution ID: **23** Type: **not specified**

Singularities and String Theory

Tuesday 5 October 2010 16:00 (30 minutes)

In my talk I will present DLCQ procedure and explain how it can be generalized to some special IIA backgrounds, Singular Homogeneous Plane-Waves. These space-times can be seen as Penrose limits of a very large class of metrics, including the Friedmann-Robertson-Walker cosmological model, so a non-perturbative string theory model such as that provided by DLCQ can hopefully teach us something more about the physics of the singularity. In fact this procedure leads to a non-Abelian theory of matrix coordinates with a time-dependent Yang-Mills coupling, and we will discuss the behavior of this theory close to the singularity and far away from it, where one should make conctact with perturbative string theory in flat space.

Presenter: Mr SERI, Lorenzo (SISSA, Italy and University of Nova Gorica, Slovenia)

Session Classification: The Universe - from the Big Bang to the Present

Contribution ID: **24** Type: **not specified**

Cosmic time with quantum matter?

Friday 8 October 2010 09:30 (1 hour)

In this talk the physical foundations for setting up the cosmological standard model with a cosmic time parameter are examined. In particular, I discuss the role of Weyl's principle which asserts that cosmic matter moves according to certain regularity requirements. I argue that although Weyl's principle is often not explicitly mentioned in modern standard texts on cosmology, it is in fact necessary for a physically well-defined notion of cosmic time. I question the prospect of satisfying Weyl's principle, and hence define cosmic time, at a very 'early phase'of the universe if this phase is contemplated to be describable exclusively in terms of quantum theory.

Presenter: Prof. ZINKERNAGEL, Henrik (University of Granada, Spain)

Session Classification: Philosophical Perspectives on Time and Fundamental Physics

Contribution ID: **25** Type: **not specified**

Epistemic-ontic interpretation of quantum mechanics: quantum information theory and Husserl's phenomenology?

Friday 8 October 2010 10:30 (30 minutes)

The opposition between Einstein and Bohr has been often described as the opposition between an epistemological and an ontological approach towards quantum mechanics. Although both frameworks (ontological and epistemological) have been later recognized as supplementary rather than contradictory, they have stayed more or less isolated from one another. An interesting possibility for exceeding this opposition has been offered by the quantum information theory, which is based on the epistemological approach, but at the same time, because of its connection with philosophical tradition, offers a possibility for an ontological supplementation.
An epistemologically-ontological interpretation based on quantum information theory and phenomenology thus enables more complex understanding of quantum mechanics –including the observer and his role as well as the role of the observed reality –essentially based on re-united aspects of physics and philosophy.

Presenter: Dr BILBAN, Tina (IQOQI Vienna. Austria)

Session Classification: Philosophical Perspectives on Time and Fundamental Physics

Contribution ID: **29** Type: **not specified**

Discovering bottom squark coannihilation at the ILC

Thursday 7 October 2010 16:15 (30 minutes)

We study the potential of the international linear collider (ILC) at √s=500 GeV to probe new dark matter motivated scenario where the bottom squark (sbottom) is the next-to-lightest supersymmetric particle. For this scenario, which is virtually impossible for the LHC to test, the ILC has a potential to cover a large fraction of the parameter space. The challenge is due to a very low energy of jets, below 20–30 GeV, which pushes the jet clustering and flavor tagging algorithms to their limits. The process of sbottom pair production was studied within the SiD detector concept. We demonstrate that ILC offers a unique opportunity to test the supersymmetry parameter space motivated by the sbottom-neutralino coannihilation scenario in cases when the sbottom production is kinematically accessible. The study was done with the full SiD simulation and reconstruction chain including all standard model and beam backgrounds.

Presenter: Dr MEDIN, Gordana (University of Montenegro)

Session Classification: Dark Matter