

CHIPP PhD Winter School 2010

Report of Contributions

Contribution ID: 0

Type: **not specified**

Model-independent cosmological constraints from the CMB

Wednesday, 20 January 2010 15:00 (20 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 $l \approx 40$ from the analysis. We consider the WMAP five-year as well as ACBAR 2008 observations. We obtain constraints on Ω_b , Ω_m and n_s , which can be applied as priors in other analysis without committing to a specific model of the late universe.

Synopsis of the talk

The cosmic microwave background (CMB) is one of the most important cosmological probes. The pattern of acoustic oscillations of the baryon-photon plasma is imprinted on the CMB at the time of decoupling, and then rescaled (and on large scales modified) as the CMB photons propagate from the last scattering surface to the observer. The CMB is thus sensitive to cosmological parameters in two ways, via the physics at decoupling and via evolution in the later universe. While the physics at decoupling (essentially atomic physics and general relativity in the linear regime) is well understood, the evolution at late times deviates from the predictions of the linearly perturbed FRW models with radiation and matter. The difference may be due to an exotic matter component with negative pressure, deviation of gravity from general relativity or a breakdown of the homogeneous and isotropic approximation. It is not known which of these possibilities is correct, and there are large differences between the various models. It is therefore worthwhile to analyse the CMB in a manner which is as independent of the details of late-time cosmology as possible. On the one hand, this makes it clear what constraints all models of late-time cosmology, whatever their details, have to satisfy in order to agree with the CMB observations. On the other hand, such analysis gives limits on the physical parameters at decoupling that are independent of the details of late-time cosmology. This is particularly important for cosmological parameters such as the density of baryons or dark matter which are used as constraints on particle physics models involving e.g. supersymmetry or baryogenesis, which have otherwise nothing to do with late-time cosmology. Such a separation of constraints is possible because the physics after decoupling affects the CMB in a rather limited manner, by changing the angular scale of the CMB pattern (apart from the low multipoles). We analyse the CMB by encoding this effect in a single parameter, the angular diameter distance to the last scattering surface. We also aim to be transparent about how the different cosmological parameters enter the analysis, and which assumptions are made. Therefore, I will begin with a short discussion about how the early and late physics affects the CMB and explain our assumptions. I will then present the results of the analysis of the WMAP 5-year and ACBAR 2008 data and give constraints on cosmological parameters, and finally, I will discuss the results and conclude.

Presenter: VONLANTHEN, Marc

Session Classification: Student talks

Contribution ID: 1

Type: **not specified**

The influence of WIMP dark matter on low-mass stars

Wednesday, 20 January 2010 15:20 (20 minutes)

The formation and evolution of low-mass stars within dense halos of dark matter (DM) leads to evolution scenarios quite different from the classical stellar evolution. For high DM densities, these stars stop their gravitational collapse before reaching the main sequence. Such stars remain indefinitely in an equilibrium state with lower effective temperatures, the annihilation of captured DM particles in their core being the only source of energy. In the case of lower DM densities, these proto-stars continue their collapse and progress through the main sequence burning hydrogen at a lower rate. I will also show the strong dependence of the effective temperature and luminosity of these stars on the characteristics of the DM particles (mass, scattering cross sections) and how this can be used as an alternative method for DM research.

Presenter: CASANELLAS, Jordi

Session Classification: Student talks

Contribution ID: 2

Type: **not specified**

Primordial magnetic fields and their gravitational wave production

Wednesday, 20 January 2010 15:40 (20 minutes)

I will briefly review the current status of magnetic field observations in galaxies and clusters. These experimental observations can be explained assuming that the primordial Universe was permeated by a seed magnetic field. Several mechanisms have been proposed to generate such a primordial field. I will explain how to obtain useful constraints on the amplitude of seed magnetic fields by studying their production of gravitational waves: these upper bounds turn out to be very stringent for both helical and non-helical primordial magnetic fields.

Presenter: FENU, Elisa

Session Classification: Student talks

Contribution ID: 3

Type: **not specified**

B_s0 branching fractions measurements at Belle

Wednesday, 20 January 2010 16:30 (20 minutes)

The general-purpose Belle detector is located at the KEK B factory (Tsukuba, Japan). This asymmetric e^+e^- collider was designed to produce a large number of $B0$ and B^+ meson pairs by running at a center-of-mass energy near the $\Upsilon(4S)$ resonance ($\sqrt{s} \approx 10.58$ GeV). By increasing the energy above the $B_s0\bar{B}_s0$ threshold, the large potential of the B factories for exploring the poorly-known B_s0 meson was quickly demonstrated. So far, the Belle detector have accumulated more than $\approx 100 \text{ fb}^{-1}$ at the $\Upsilon(5S)$ energy ($\sqrt{s} \approx 10.87$ GeV) representing ~ 3 millions of B_s0 pairs. This represents 99% of the world's sample at this energy. The study of the B_s0 is of high interest and the Belle sample, where the number of produced B_s0 is accessible, is a unique chance to measure precisely an absolute branching fraction. The measurement of five B_s0 branching fractions using the first 23.6 fb^{-1} of data will be described, and prospects for improving the precision through a better normalization will be discussed. The full reconstruction of a clean $B_s0 \rightarrow D_s^- \pi^+$ sample (161 ± 15 events) provided the current most precise measured B_s0 branching fraction. Additionally, the B_s^* and B_s0 masses and the B_s0 production-mode fractions were also measured. A 3.5σ evidence for its Cabibbo-suppress counterpart $B_s0 \rightarrow D_s^+ K^\pm$ was obtained. This analysis was recently extended to three other dominant modes including photons in their final states and led to the first observations of the $B_s0 \rightarrow D_s^{*-} \pi^+$, $B_s0 \rightarrow D_s^- \rho^+$ and $B_s0 \rightarrow D_s^{*-} \rho^+$ modes.

Presenter: LOUVOT, Remi**Session Classification:** Student talks

Contribution ID: 4

Type: **not specified**

Hadronic Event Shapes at CMS

Wednesday, 20 January 2010 16:50 (20 minutes)

A study of hadronic event shapes in QCD events at the Large Hadron Collider (LHC) is shown. The study is based on a Geant detector simulation of the Compact are robust under variations of the jet energy scale and resolution effects, which makes them Calorimetric jet momenta are used as input for calculating various event-shape variables, which probe Muon Solenoid (CMS) detector. the structure of the hadronic final state. It is shown that the normalized event-shape distributions particularly suitable for early data analysis and tuning of Monte Carlo models.

Presenter: WEBER, Matthias Artur (Eidgenossische Tech. Hochschule Zuerich (ETHZ))

Session Classification: Student talks

Contribution ID: 5

Type: **not specified**

Jet veto systematics in the WW decay channel of the Higgs boson search with the CMS experiment

Wednesday, 20 January 2010 17:10 (20 minutes)

Jet veto systematics in the WW decay channel of the Higgs boson search with the CMS experiment. The $t\bar{t}$ production is contributing a large fraction of the background in the WW channel. It can be drastically reduced with a jet veto. Therefore detailed studies of the jet systematics of the $t\bar{t}$ pair production and the impact on the Higgs search are needed and will be discussed. These studies have been carried out using a detailed Monte Carlo simulation of the detector response.

Presenter: PUNZ, Thomas (IPP ETH Zürich)

Session Classification: Student talks

Contribution ID: 6

Type: **not specified**

BREAK

Wednesday, 20 January 2010 17:30 (10 minutes)

Session Classification: Student talks

Contribution ID: 7

Type: **not specified**

ttbar and W+jet background estimate for hadronic SUSY searches at CMS

Wednesday, 20 January 2010 17:40 (20 minutes)

To recognise supersymmetric decays or other rare processes, the standard model background for these signatures have to be predicted as precisely as possible. At the CMS experiment the reference analysis 2 is looking for supersymmetry in the purely hadronic channel. In this talk a data driven background estimate to this analysis for the ttbar and W+jet channel with muons or electrons in the final state on the basis of a cut inversion of the lepton veto cut is presented.

Presenter: THOMSEN, Jan Detlef (UHH - Institut fuer Experimental Physik-Universitaet Hamburg-Un)

Session Classification: Student talks

Contribution ID: 9

Type: **not specified**

Search for SUSY signatures with the CMS detector in events with electron(s), jets and missing energy: Handling of QCD background

Wednesday, 20 January 2010 18:00 (20 minutes)

Generic signatures of supersymmetry with R-parity conservation include same-sign isolated dielectron pairs, accompanied by energetic jets and missing transverse energy. The detection of these signatures relies on the observation of an excess of events over Standard Model background expectations. In this study we present different methods to control and estimate Standard Model backgrounds for same-sign dielectron final states. The study is performed for several mSUGRA benchmark points, with the full simulation of the CMS detector and for an integrated luminosity of 100 pb⁻¹.

Presenter: MILENOVIC, Predrag (Vinca Institute of Nuclear Sciences (VINCA))

Session Classification: Student talks

Contribution ID: 10

Type: **not specified**

Muon-detector studies for the CMS upgrade at SLHC

Thursday, 21 January 2010 09:00 (20 minutes)

The (planned) SLHC upgrade will make it necessary to handle up to 10 times higher muon rates. For this purpose the development of additional sub-detectors is needed. One option would be the use of fast scintillation detectors as muon taggers for a L1 trigger support. Because of the high B-field and the strongly limited space, it seems evident to use SiPMs as readout devices. Simulations and prototype tests are needed in order to determine proper detector materials and geometries, readout schemes and SiPM types. This talk presents the results of GEANT4-based simulations addressing these issues. Furthermore, first results from test setups are shown.

Presenter: PAPACZ, Paul**Session Classification:** Student talks

Contribution ID: 11

Type: **not specified**

Measurements of the Lorentz angle in the CMS barrel pixel detector with collisions and cosmic data

Thursday, 21 January 2010 09:20 (20 minutes)

Preliminary results for the Lorentz angle in the silicon barrel pixel detector of the CMS experiment are presented. Two different methods are used to extract the Lorentz angle from the first LHC collision data and from cosmic data.

Presenter: RIKOVA, Mirena Ivova

Session Classification: Student talks

Contribution ID: 12

Type: **not specified**

First Alignment of the Complete CMS Tracker

Thursday, 21 January 2010 09:40 (20 minutes)

An overview to the alignment of the inner tracker is given together with a brief description of alignment approaches and algorithms used. Results from cosmic runs in 2008 and 2009 will be presented as well as some impacts of alignment to physics analyses.

Presenter: MEIER, Frank (Nuclear and Particle Physics Dept.-Paul Scherrer Institut (PSI)-)

Session Classification: Student talks

Contribution ID: 13

Type: **not specified**

ArDM, a liquid argon dark matter experiment

Saturday, 23 January 2010 10:00 (20 minutes)

ArDM is an experiment for direct detection of weakly interacting massive particles in the universe with a double phase liquid argon calorimeter / TPC. The detector discussed in this talk has a fiducial volume of about 1 ton of liquid argon and the detection is done independently by the collection of ionizing charge as also of scintillation light. In this talk I'll present an overview over newly built parts of the detector as also measurements with cosmic muons and external sources using the light read out system. Further there will be first measurements with electron collection and an applied drift field over about 120 cm.

Presenter: EPPRECHT, Lukas (Institut fuer Teilchenphysik-Eidgenossische Tech. Hochschule Zue)

Session Classification: Student talks

Contribution ID: 14

Type: **not specified**

The XENON100 Detector for Dark Matter Searches

Saturday, 23 January 2010 10:20 (20 minutes)

The XENON100 detector, which has replaced the XENON10 prototype in the same shield and location at the Gran Sasso Underground Laboratory, is a dual phase (liquid-gas) xenon time-projection chamber for particle detection. The total amount of liquid xenon is 165 kg, of which 65 kg are in the active target enclosed in a teflon/copper structure, the rest being in the surrounding active veto. The direct and proportional UV light signal produced by particle interactions is detected by 242 PMTs (98 in the top array, 80 in the bottom array and 64 in the veto). The expected sensitivity of the XENON100 for spin-independent WIMP-nucleon couplings is $2e-45$ cm² for a 100GeV WIMP, with a planned (background-free) raw exposure of 6000 kg x days. In this talk, the present status of the XENON100 experiment and the near-future plans will be reported.

Presenter: KISH, Alexander

Session Classification: Student talks

Contribution ID: 15

Type: **not specified**

Construction and operation of a double phase pure Argon LEM-TPC

Saturday, 23 January 2010 10:40 (20 minutes)

In this talk I will describe construction and operation of a 3 litre chamber based on the new concept of double phase pure argon Large Electron Multiplier Time Projection Chamber (LAr LEM-TPC): after drifting in liquid argon, the ionization electrons are extracted from the liquid to the vapour phase, where multiplication occurs due to high electric fields in the vicinity of the LEM holes. The multiplied electrons induce signals on two segmented collection electrodes allowing energy and position reconstruction of ionizing events. As I will show, cosmic muons have been used to monitor the liquid Argon purity and the gain achieved with a 1 mm thick LEM. We believe that this kind of tracking and calorimetric device finds its application in next generation neutrino physics and proton decay experiments as well as in direct Dark Matter search (ArDM).

Presenter: LUSSI, Devis Orlando (Institut fuer Teilchenphysik-Eidgenossische Tech. Hochschule Zue)

Session Classification: Student talks

Contribution ID: 16

Type: **not specified**

EXO R&D in Bern

Saturday, 23 January 2010 11:30 (20 minutes)

The EXO collaboration aims to detect the neutrino-less double beta decay using xenon isotopically enriched in the isotope 136. R&D is being conducted in Bern, Switzerland, towards the construction of a ton-class detector. A high-resolution micropattern (MicroMegas) readout system is being studied. The scheme offers full tracking capabilities and 3D event reconstruction for possible application in a future gas-phase EXO detector.

Presenter: GIROUX, Guillaume**Session Classification:** Student talks

Contribution ID: 17

Type: **not specified**

EXO-200

Saturday, 23 January 2010 11:50 (20 minutes)

EXO-200 (Enriched Xenon Observatory - 200kg) is an underground double-beta decay experiment that uses 200kg of Xenon isotopically enriched to 80% in Xenon-136. The Xenon is contained in an ultra-low background TPC where there is simultaneous collection of scintillation light (using Large Area Avalanche Photodiodes (LAAPD's)) and ionization charge in order to significantly enhance the energy resolution. EXO-200 should measure the, as yet unobserved, two neutrino double-beta decay mode as well as achieve competitive sensitivity for the neutrinoless double-beta decay mode of Xenon-136. EXO-200 is currently undergoing final construction and commissioning. R&D is being conducted towards the construction of a ton-class detector.

Presenter: AUGER, Martin

Session Classification: Student talks

Contribution ID: 18

Type: **not specified**

Development of a monitoring system for the Ultra-Cold Neutron (UCN) source at PSI

Saturday, 23 January 2010 12:10 (20 minutes)

At the Paul Scherrer Institute (PSI) in Villigen, Switzerland, the construction of a high intensity ultra-cold neutron source is nearing completion. It uses a 1.3 MW proton beam for the production of neutrons in a spallation target. After moderation the UCN enter a ~ 2 m³ storage volume inside a biological shield. From there they can be transported to the experiments via UCN guides.

A detection system is being developed to monitor the UCN density inside the storage volume. The system will have to withstand a very high neutron and gamma radiation level of up to 13 MGy/y. The detector will have to operate in a clean vacuum and at a temperature of ~ 60 K. Furthermore, the detection system has to be small in order not to decrease the UCN storage properties of the storage volume substantially. The detector is based on a 1-2 mm² ⁶Li-glass scintillator which is read out by a Geiger-Mode APD at the end of a 5 m long quartz light guide.

An overview of the ongoing development work will be presented.

Presenter: GOELTL, Leonard

Session Classification: Student talks

Contribution ID: 19

Type: **not specified**

Commissioning of the CMS pixel detector using first data

Sunday, 24 January 2010 10:00 (20 minutes)

The Compact Muon Solenoid (CMS) experiment is one of the four detectors exploiting the proton-
The pixel detector is the innermost detector of CMS that is essential in measuring the trajectories of charged particles with high precision. The detector was installed in summer 2008 and commissioned with cosmic data. First data, arriving at the end of 2009, will be used for further commissioning. In this talk I will discuss the performance of the pixel detector and present comparisons between data and Monte Carlo simulations. proton collisions delivered by the Large Hadron Collider (LHC) at CERN.

Presenter: JAEGER, Andreas

Session Classification: Student talks

Contribution ID: 20

Type: **not specified**

Simulation studies for the Phase 1 upgrade of the CMS pixel detector

Sunday, 24 January 2010 10:20 (20 minutes)

Towards the end of 2009 the first collisions are expected to take place at the Large Hadron Collider at CERN. After about four years of operation, the accelerator will be upgraded to the so-called Phase 1: a peak luminosity of $2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ is expected, resulting in an increase by a factor of two with respect to the initial specifications. In this occasion, the CMS pixel detector will be replaced with an upgraded system, with major changes to the mechanical structure, front-end electronics and the cooling system. In this presentation I discuss the performance of the pixel detector and track reconstruction with the new layout, based on Monte Carlo simulations.

Presenter: FAVARO, Carlotta

Session Classification: Student talks

Contribution ID: 21

Type: **not specified**

to be defined

Sunday, 24 January 2010 10:40 (20 minutes)

Session Classification: Student talks