

# **KRUGER2012 International Workshop on Discovery Physics at the LHC**

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## **Book of Abstracts**



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## The Thermal Model at the LHC

**Author:** Jean Cleymans<sup>1</sup>

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The status of the thermal model is presented.

**Presentation Type:**

plenary

**Parallel Session V: Quarkonia / 1**

## Quarkonium Production at STAR

**Author:** Christopher Powell<sup>1</sup>

<sup>1</sup> *Lawrence Berkeley National Laboratory / University of Cape Town*

**Corresponding Author:** cpowell001@gmail.com

The production of quarkonium has been studied to provide information about the Quark Gluon Plasma (QGP) that is expected to be created in relativistic heavy ion collisions at RHIC. Lattice QCD predicts a suppression of quarkonium production in a hot and dense nuclear medium, due to the Debye screening of the potential between heavy quarks, relative to proton-proton collisions. The suppression pattern of the various quarkonium states may provide insight into the thermodynamic properties of the QGP. However, there are other effects which may contribute to the modification of heavy quarkonium production, such as formation-time effects, statistical coalescence of heavy quark-antiquark pairs, the modification of nuclear PDFs (shadowing), and nuclear absorption, which need to be taken into account in order to fully quantify a suppression in heavy ion collisions. This can be achieved by studying the production of various quarkonium states in p+p, d+A, and A+A collisions.

In this talk we will report the results on heavy quarkonium production in p+p, d+Au, and Au+Au collisions at midrapidity via the dielectron decay channel at  $\sqrt{s_{NN}} = 200$  GeV from STAR. Results from J/psi production in p+p collisions will be presented to provide a baseline for production and understand the quarkonium production mechanism. The nuclear modification factor for J/psi in d+Au and Au+Au will also be reported, along with results from Upsilon production in p+p, d+Au, and Au+Au collisions.

**Presentation Type:**

Presentation

**Parallel Session XIII / 2**

## Implications of LHC results for Supersymmetry

**Author:** Sabine Kraml<sup>1</sup>

<sup>1</sup> *LPSC Grenoble***Corresponding Author:** sabine.kraml@lpsc.in2p3.fr

We discuss how the current LHC results, often presented in the context of the CMSSM or simplified models, constrain supersymmetry in general. To this end, we are particularly interested in “natural” or “effective” SUSY” scenarios, which are preferred on the one hand by theoretical considerations, and on the other hand by flavor constraints. Moreover, assuming that the LHC and Tevatron excesses hinting at a Higgs with mass near 125 GeV (and a signal strength somewhat larger than SM expectations in some channels) persist, we assess the extent to which this can be accommodated in minimal and non-minimal SUSY models. Here we are particularly interested in determining the extent to which the Higgs data discriminates between or possibly eliminates potentially realistic GUT scenarios. Finally, combining Higgs and SUSY results with data regarding relic dark matter density and dark matter searches, we discuss predictions for the LHC at 13 TeV.

**Presentation Type:**

review

**Parallel Session I: BSM, Exotics / 3**

## **Probing extra-dimensions at the LHC using quartic photon W and photon Z anomalous couplings**

**Author:** Christophe Royon<sup>1</sup><sup>1</sup> *IRFU-SPP, CEA Saclay***Corresponding Author:** christophe.royon@cea.fr

We present a new method to test the Standard Model expectations at the LHC using photon-induced WW and ZZ productions. Both W decay in the main ATLAS or CMS detectors while scattered protons are measured in forward detectors. The sensitivity to anomalous WW  $\gamma\gamma$  and ZZ  $\gamma\gamma$  quartic couplings can be improved respectively by four orders of magnitude compared to the present LEP limits, allowing to probe with an unprecedented precision higgsless or extra dimension models. Details will be given how to achieve these results using an upgrade of the ATLAS or CMS experiment.

**Presentation Type:**

Plenary talk

5

## **The African School of Fundamental Physics and its Applications**

**Author:** Ketevi Assamagan<sup>1</sup><sup>1</sup> *BNL***Corresponding Author:** ketevi@bnl.gov

We have established a biennial school of physics in Africa, on fundamental subatomic physics and its applications. The aim of the school is to build capacity to harvest, interpret, and exploit the results



of current and future physics experiments with particle accelerators, and to increase proficiency in related applications, such as medicine, and technologies. The school is based on a close interplay between theoretical, experimental, and applied physics. The first school took place in Stellenbosch, South Africa on 1–21 August 2010. We proposed the second edition of the biennial school in Ghana on 15 July – 8 August 2012. In this talk, we will present the activities of both schools in 2010 and 2012.

**Presentation Type:**

Oral Presentation

**Parallel Session II: Heavy Ion Collisions / 6**

## Measurement of coherent J/Psi production in Ultra-Peripheral Collisions with the ALICE detector at the LHC

**Author:** Guillermo Contreras<sup>1</sup>

<sup>1</sup> *CVUT Praga*

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Ultra-relativistic heavy ions generate strong electromagnetic fields which offer the possibility to study gamma-gamma and gamma-nucleus processes at the LHC in the so called ultra-peripheral collisions (UPC). The coherent photoproduction of J/Psi vector mesons in UPC is sensitive to the gluon distribution of the interacting nuclei. Here we report on ALICE results of J/Psi coherent production measured in PbPb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV where the J/Psi has been measured in the  $\mu\mu$  decay channel with the Alice Muon Spectrometer in the rapidity range  $-3.6 < y < -2.6$ .

**Presentation Type:**

Talk

**Parallel Session I: BSM, Exotics / 13**

## Searches for neutral and charged Higgs bosons in the ATLAS experiment as a test of physics beyond the Standard Model

**Author:** Arnaud Ferrari<sup>1</sup>

<sup>1</sup> *Uppsala University*

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In several theories beyond the Standard Model, the Higgs sector consists of more than one complex scalar doublet. For instance, supersymmetric models such as MSSM have 5 physical Higgs states, two charged and three neutral. In this presentation, a review of the searches for new neutral and charged Higgs bosons in ATLAS at the Large Hadron Collider is presented.

**Presentation Type:**

Invited talk

**Parallel Session II: Heavy Ion Collisions / 16****Light-flavour identified charged-hadron production in pp and Pb–Pb collisions at the LHC****Author:** Roberto Preghenella<sup>1</sup><sup>1</sup> *Museo Storico della Fisica e Centro di Studi e Ricerche "Enrico Fermi" and INFN Sezione di Bologna***Corresponding Author:** preghenella@bo.infn.it

Thanks to the unique detector design adopted to fulfil tracking and particle-identification (PID) requirements (e.g. low momentum cut-off and low material budget), the ALICE experiment provides significant information about hadron production both in pp and Pb–Pb collisions. In particular, the spectral shapes and production yields of identified particles play a key role in the study of the collective and thermal properties of the matter formed in high-energy heavy-ion collisions. Furthermore, the production of high- $p_T$  particles provides insights into the density of the medium and the in-medium energy-loss mechanisms.

Transverse momentum spectra of  $\pi^+$ ,  $K^+$ , p and  $\bar{p}$  are measured at mid-rapidity ( $|y| < 0.5$ ) over a wide momentum range, from  $\sim 100$  MeV/c up to  $\sim 20$  GeV/c. The measurements are performed exploiting the dE/dx in silicon (ITS) and gas (TPC), the time-of-flight (TOF) and the ring-imaging Cherenkov (HMPID) particle-identification techniques, which will be briefly reviewed in this report. The current results on light-flavour charged-hadron production will be presented for pp collisions at  $\sqrt{s} = 0.9, 2.76$  and 7 TeV and for Pb–Pb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV. Production yields, spectral shapes and particle ratios in pp are discussed as a function of the collision energy and compared to previous experiments and commonly-used Monte Carlo models. Pb–Pb collisions at the LHC feature the highest radial flow ever observed and an unexpectedly low  $p/\pi$  production ratio. The results are presented as a function of collision centrality and compared to RHIC data in Au–Au collisions at  $\sqrt{s_{NN}} = 200$  GeV and predictions from thermal and hydrodynamic models. The nuclear modification factor ( $R_{AA}$ ) of identified hadrons will also be discussed and compared to unidentified charged particles and theoretical predictions. This is observed to be identical for all particle species at high- $p_T$ .

**Presentation Type:**

parallel

**Parallel Session II: Heavy Ion Collisions / 18****(Anti-)matter and hyper-matter production at the LHC with ALICE****Author:** Nicole Alice Martin<sup>1</sup><sup>1</sup> *Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany***Corresponding Author:** n.martin@gsi.de

ALICE is the experiment at the CERN LHC dedicated to the investigation of nucleus–nucleus collisions at the highest energies ever reached in the laboratory. The excellent particle identification capabilities of ALICE allow for the reconstruction of a significant number of rare states or

even exotic ones. In this talk we present results from a sample of Pb–Pb collisions at a center of mass energy of  $\sqrt{s_{NN}} = 2.76$  TeV per nucleon–nucleon pair. Light nuclei up to  $^3\text{He}$  and  $^4\text{He}$  as well as the corresponding anti-nuclei have been identified based on their specific energy loss in the Time Projection Chamber and velocity information from the Time-Of-Flight detector. (Anti-)hyper-tritons have been reconstructed via their mesonic decay ( $^3\Lambda\text{H} \rightarrow ^3\text{He} + \pi$ ) exploiting their secondary vertex decay topology. The ( $^3\text{He}, \pi$ ) invariant mass spectrum will be presented. In addition, searches for even lighter hyper-matter states, i.e.  $\Lambda\bar{\Lambda}$  (also known as H-Dibaryon) and  $\Lambda\bar{\Lambda}$ -n bound states, will be discussed. The results will be compared with model expectations.

**Presentation Type:**

Invited Talk

19

## Towards the Little Bang Standard Model

**Author:** Ulrich Heinz<sup>1</sup>

<sup>1</sup> *The Ohio State University*

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The Little Bangs created in ultrarelativistic heavy-ion collisions share many characteristic features with the cosmological evolution after the Big Bang. I will demonstrate how quantum fluctuations in the initial state of the Little Bang propagate via hydrodynamic evolution (supplemented by an early pre-equilibrated thermalization and a late kinetic freeze-out stage) into the experimentally observed final state, manifesting themselves as fluctuations in the final flow pattern. A harmonic analysis of the final flows, their transverse momentum dependence and their flow angles (the “Little Bang flow fluctuation spectrum”) provides detailed information from which the spectrum of gluon fluctuations in the initial state and the transport coefficients of the quark-gluon plasma fluid created in the collisions can be quantitatively extracted.

**Presentation Type:**

Talk

### Parallel Session VIII: Heavy Ion Collisions / 20

## Photoproduction of $\rho_0$ in Ultra-Peripheral Nuclear Collisions at ALICE

**Author:** Kyrre Skjerdal<sup>1</sup>

<sup>1</sup> *University of Bergen*

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Photoproduction of  $\rho_0$  mesons in ultra-peripheral Pb+Pb collisions has been studied by the ALICE Collaboration at the CERN LHC. The strong photon flux associated with relativistic charged particles leads to a very large cross section for exclusive photoproduction of  $\rho_0$  meson in interactions of the type  $Pb + Pb \rightarrow Pb + Pb + \rho_0$ . For a  $\rho_0$  produced at mid-rapidity at the LHC, the photon-nucleus center of mass energy is roughly a factor of three higher than in any previous experiment. The

ALICE detector is a general purpose detector dedicated to study heavy-ion collisions. ALICE has excellent performance in the low  $p_T$  region, and can reconstruct charged particle tracks with  $0.1 \text{ GeV}/c \leq p_T \leq 100 \text{ GeV}/c$ . In this analysis some of the major components of the ALICE central barrel are used: The Inner Tracking System, with six layers of silicon detectors, is used for the first part of the tracking and for finding the collision vertex. Outside of the Inner Tracking System is the Time Projection Chamber, which is the main tracking device in ALICE. Trigger information is provided by the following detectors: The Time-Of-Flight (TOF), located outside the TPC; the VZERO detectors, plastic scintillators located outside of the central barrel, covering roughly two units of pseudorapidity on either side of mid-rapidity; and by the Silicon-Pixel Detector (SPD), a part of the Inner Tracking System. In the 2010 Pb-Pb run there were two different triggers for ultra-peripheral collisions in the ALICE central barrel. For the first part of the run a trigger which required a signal of at least two hits in the TOF was used. Later in the run the trigger also included a signal of at least two hits in the SPD and a veto on the VZERO detectors. The data for both triggers in the 2010 heavy-ion run has been analysed. Preliminary results on  $\rho$  production will be presented.

**Presentation Type:**

Slides

**Parallel Session X / 21**

## Does p-p soft scattering attain saturation at the TeV-scale?

**Author:** Uri MAOR<sup>1</sup>

<sup>1</sup> *Tel Aviv University*

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The properties of p-p scattering amplitudes at the TeV-scale and above are studied, so as to check their asymptotic behavior and determine the rate at which they approach the bounds implied by s and t channel unitarity saturation. I shall examine the available cross sections at exceedingly high energies, as well as the corresponding behavior of the coupled models aiming to reproduce the values of this data. My conclusion is that p-p black body saturation is not attained at the TeV-scale. More over, I do not expect that the saturation bounds will be attained at energies that can be reached.

**Summary:**

s and t unitarity saturation in p-p scattering is assessed.

**Presentation Type:**

pdf

**Parallel Session III: Theory / 22**

## Tomography of the QGP by open charm and bottom mesons

**Author:** Joerg Aichelin<sup>1</sup>

**Co-authors:** Marcus Bluhm <sup>2</sup>; Pol Gossiaux <sup>2</sup>; Thierry Gousset <sup>2</sup>

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**Corresponding Author:** aichelin@subatech.in2p3.fr

Study of the radiative and collisional energy loss of heavy quarks in a QGP and the following hadronisation. Analysis of the recent RHIC and LHC B and D meson data.

**Summary:**

One of the primary goals of the relativistic heavy ion program at RHIC and LHC is the study of the properties of the QGP. This is not that easy because light quarks seem to come to a thermal equilibrium at the end of the expansion and therefore light hadrons show only the properties at the phase transition points. Heavy quarks, on the contrary, do not come to equilibrium with the environment and therefore the final heavy meson spectra carries information on the early stage of the QGP expansion. We have developed a pQCD based model for the elementary interaction of heavy quarks with the plasma particles and studied the heavy quark interaction with the expanding QGP in a transport theory where the plasma is described by a hydrodynamical approach. In particular we study the energy loss and the elliptic flow and compare the results with recent experimental data. Emphasis will be put on the influence of an absorptive medium on the radiative energy loss and the Landau Pomeranchuk Migdal effect which we have recently studied in detail.

We compare our results with RHIC and LHC data and draw conclusions about the properties of the early expansion phase of the plasma.

**Presentation Type:**

oral

**Parallel Session III: Theory / 23**

## The QGP dynamics in relativistic heavy-ion collisions

**Author:** Elena Bratkovskaya<sup>1</sup>

<sup>1</sup> *ITP, FIAS, Uni. Frankfurt*

**Corresponding Author:** elena.bratkovskaya@th.physik.uni-frankfurt.de

The dynamics of partons and hadrons in relativistic nucleus-nucleus collisions is analyzed within the novel Parton-Hadron-String Dynamics (PHSD) transport approach, which is based on a dynamical quasiparticle model for partonic phase (DQPM) including a dynamical hadronization scheme. The PHSD model reproduces a large variety of observables from SPS to LHC energies, e.g. as quark-number scaling of elliptic flow, transverse mass and rapidity spectra of charged hadrons, dilepton spectra, open and hidden charm production, collective flow coefficients etc., which are associated with the observation of a sQGP. The 'highlights' of the latest results will be presented and open questions/perspectives will be discussed.

**Presentation Type:**

talk

**Parallel Session XIII / 24**

## Charged particle production in Pb-Pb collisions in ALICE

**Author:** Chiara Oppedisano<sup>1</sup>

<sup>1</sup> *INFN Sezione di Torino*

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Global event observables are a fundamental tool to characterize the properties of the strongly interacting medium created in heavy-ion collisions at the LHC. The ALICE experiment measured charged particle multiplicity distributions in Pb-Pb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV in a wide pseudo-rapidity range ( $-5 < \eta < 5.5$ ) using different techniques. In heavy-ion interactions the centrality of the collision is estimated through a Glauber Monte Carlo fit to multiplicity distributions reconstructed in various detectors. The charged particle yields as a function of particle transverse momentum in Pb-Pb relative to pp collisions are measured to study in-medium energy loss. Charged particle pseudo-rapidity distributions and the nuclear modification factor  $R_{AA}$  will be presented for Pb-Pb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV. The results will be compared to experimental results at lower energies and to theoretical predictions.

**Presentation Type:**

talk

Parallel Session XII / 25

## Renormalisation running of masses and mixings in UED models

**Author:** Alan Cornell<sup>1</sup>

<sup>1</sup> *School of Physics, University of the Witwatersrand*

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We review the Universal Extra-Dimensional Model compactified on a  $S^1/Z_2$  orbifold, and the renormalisation group evolution of quark and lepton masses, mixing angles and phases both in the UED extension of the Standard Model and of the Minimal Supersymmetric Standard Model. We consider two typical scenarios: all matter fields propagating in the bulk, and matter fields constrained to the brane. The resulting renormalisation group evolution equations in these scenarios are compared with the existing results in the literature, together with their implications.

**Summary:**

This could run either as a theory parallel talk, or if Jean wants it modified, as a review of loop calculations for students (may be a bit high level for them though). My student Ammar, should his financial support application be approved, would present a poster on the same sort of material.

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## Observation of Paramagnetic Fe<sup>3+</sup> in Mn/Fe implanted Metal Oxides and III-Nitrides

**Authors:** Deena Naidoo<sup>1</sup>; Gerd Weyer<sup>2</sup>; Guido Langouche<sup>3</sup>; Hafliði Gíslason<sup>4</sup>; Hilary Masenda<sup>1</sup>; Karl Johnston<sup>5</sup>; Krishanlal Bharuth-Ram<sup>6</sup>; Mehluhi Ncube<sup>1</sup>; Palle Gunnlaugsson<sup>2</sup>; Rainer Sielemann<sup>7</sup>; Roberto Mantovan<sup>8</sup>; Sveinn Ólafsson<sup>4</sup>; Torben Molholt<sup>4</sup>; Wendy Dlamini<sup>9</sup>

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1 School of Physics, University of KwaZulu-Natal, South Africa; 2 Institute of Physics and Astronomy, Aarhus University, Aarhus, Denmark; 3 Science Institute, University of Iceland, Reykjavík, Iceland; 4 School of Physics, University of the Witwatersrand, South Africa; 5 Laboratorio MDM IMM-CNR, Agrate Brianza (MB), Italy; 6 EP Division, ISOLDE/CERN, Switzerland; 7 Helmholtz Zentrum – Berlin, Germany; 8 Department of Physics, KU - Leuven, Leuven, Belgium.

Theoretical prediction of ferromagnetic behaviour above room temperature in ZnO (and GaN) doped with dilute concentrations (6 – 8%) of transition metal (TM) ions has excited considerable interest because of their potential as semiconductor-compatible magnetic components for spintronic applications. Observation of room temperature ferromagnetism (RTFM) in ZnO doped with TM ions have been reported, however, no clarity exists on the origin of the observed magnetism, which has been attributed to dopant-defect complexes, unintentional precipitation, or to the formation of secondary magnetic phases. The Mössbauer Collaboration at ISOLDE/CERN has applied  $^{57}\text{Fe}$  emission Mössbauer spectroscopy following the implantation of  $^{57}\text{Mn}^*$ , to study the nature of the magnetism in ZnO and other metal oxides and III-nitrides. Radioactive beams of  $^{57}\text{Mn}^+$  ( $T_{1/2} = 1.5$  min) ions are produced at the ISOLDE facility following fission in a  $\text{UC}_2$  target induced by 1.4 GeV protons and multi-stage element selective laser ionization. High purity beams of intensity of  $\sim 3 \times 10^8$  ions/s were implanted with 40-60 keV energy and to fluences below  $10^{12}$  ions/cm<sup>2</sup> into commercially available single crystal samples. The Mössbauer spectra obtained on-line after implantation into ZnO single crystals show magnetic hyperfine sextets originating from Fe in the high-spin  $\text{Fe}^{3+}$  state. Measurements in an external magnetic field show that these sextets are not due to ferromagnetic Fe but to paramagnetic substitutional  $\text{Fe}^{3+}$  with unusually long relaxation times. Similar high-spin  $\text{Fe}^{3+}$  paramagnetic sextet structure is also observed in MgO and  $\alpha\text{-Al}_2\text{O}_3$ . Results obtained for ZnO,  $\alpha\text{-Al}_2\text{O}_3$  and MgO, as well as preliminary results for GaN, AlN and InN, will be presented.

**Presentation Type:**

Oral

**Parallel Session VI: Standard Model Higgs / 28**

## Property measurements of the Higgs-like Boson from CMS

**Author:** Jonathan Hays<sup>1</sup>

<sup>1</sup> *Queen Mary University London*

**Corresponding Author:** jonhays01@gmail.com

Earlier this year a new boson with a mass of around 125 GeV was discovered at the LHC. Though it is compatible with the long sought-after Higgs boson only precise measurements of its properties will confirm this. The latest results from CMS on measurements of the properties of the new boson, derived from a study of all production and decay channels measured so far, will be presented together with prospects for the future.

**Presentation Type:**

parallel

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**Strangeness production in the ALICE detector****Author:** Domenico Elia<sup>1</sup><sup>1</sup> *INFN Bari***Corresponding Author:** domenico.elia@ba.infn.it

The ALICE experiment at the LHC has measured the production of strange hadrons in Pb–Pb and pp collisions at unprecedented beam energies. Particles are reconstructed via their weak decay topologies exploiting the excellent tracking and particle identification capabilities of the apparatus. Transverse momentum spectra and yields at mid-rapidity have been studied for  $\Lambda$ ,  $\Xi$  and  $\Omega$  baryons and their anti-particles as well as for kaons. Results in Pb–Pb collisions at  $\sqrt{s_{NN}} = 2.76$  TeV for different centrality intervals will be presented and compared with pp and lower energy nucleus-nucleus measurements.

**Presentation Type:**

Plenary

**Parallel Session XII / 30****Higgs to four leptons searches at the LHC : constraints on Abelian Hidden sector models****Author:** Mathieu Arousseau<sup>1</sup><sup>1</sup> *University of Johannesburg***Corresponding Author:** mathieu.aurousseau@cern.ch

Recent results on Higgs searches at the LHC by the ATLAS and CMS collaborations claim the observation of a new boson with properties compatible with the Standard Model (SM) Higgs boson, at a mass of about 126 GeV. The production rate of the new particle seems compatible with the SM prediction. In some models beyond the SM, an Abelian Hidden sector is coupled to the Standard Model, and the resulting exotic Higgs and new gauge ( $Z'$ ) fields are allowed to mix with the corresponding SM fields. This admits new processes such as the decay of the lightest Higgs boson (after mixing) to a pair of new gauge bosons, and the decay of the new gauge bosons to pairs of leptons :  $H \rightarrow Z'Z' \rightarrow llll$ . This modifies the rate of 4-lepton events sought for in the usual SM  $H \rightarrow ZZ^* \rightarrow llll$  search. Assuming the observed particle is a Higgs boson of a mass of 126 GeV, we investigate the consequences of the addition of this new process to the search for a SM Higgs boson decaying to 4 leptons, and the resulting constraints on the Abelian Hidden sector model parameters. The constraints are drawn in terms of Higgs mixing angle and new gauge boson mass.

**Presentation Type:**

Presentation



**Parallel Session I: BSM, Exotics / 31****Searches for a light Higgs and dark photons at BABAR****Author:** Rocky So<sup>1</sup><sup>1</sup> *University of British Columbia***Corresponding Author:** rockyso@physics.ubc.ca

Babar collided electrons and positrons at a centre of mass energy of  $\sim 10\text{GeV}$  at the Stanford Linear Accelerator Center. A light CP-odd Higgs boson is expected in extensions to the Standard Model such as Next to Minimal Supersymmetry. The Babar Collaboration searched for a light Higgs boson ( $A_0$ ) produced in radiative decays of an  $Y$  meson ( $Y \rightarrow \gamma A_0$ ). We saw no evidence of the  $A_0$  decaying into  $\mu+\mu-$ ,  $\tau+\tau-$ , hadrons, or invisible final states with a sample of 122 million  $Y(3S)$ , 99 million  $Y(2S)$ , and 23 million  $Y(1S)$  from  $Y(2,3S)$  decays collected at the PEP II B-factory. We set upper limits on product branching fractions  $B(Y \rightarrow \gamma A_0) \times B(A_0 \rightarrow \text{various states})$  as low as  $10^{-6}$  for  $A_0$  masses from threshold up to  $9\text{GeV}/c^2$ . As a result, we exclude a large fraction of parameters space for Next to Minimal Supersymmetry. We also search for a dark Higgs boson motivated by astrophysical experiments using 516/fb of data collected with the BABAR detector. We could not find evidence of such a dark Higgs so we set upper limits on its branching fraction.

**Presentation Type:**

Parallel Talk

**Parallel Session IV: BSM, SUSY, Exotics / 32****Searches for Physics beyond the SM in Monojets and Monophotons events with the ATLAS detector****Author:** Ruth Pöttgen<sup>1</sup><sup>1</sup> *CERN***Corresponding Author:** ruth.poettgen@cern.ch

There are various models for physics beyond the standard model that predict event signatures with large missing transverse energy due to invisible new particles. Such events can be identified in the detector if they are accompanied by an energetic photon or a jet with high transverse energy. The main contributions to the standard model background are production of  $Z$  and  $W$  bosons together with a jet or a photon, where the  $Z$  decays into 2 neutrinos or where the decay lepton from the  $W$  is not identified.

This talk presents results from searches for new physics with both signatures with the ATLAS detector at the LHC. The focus will be on the analyses using the full 2011 data set at a center of mass energy of  $\sqrt{s}=7\text{TeV}$  but also include updates with data recorded in 2012 at  $\sqrt{s}=8\text{TeV}$ . The results are translated into exclusion limits on parameters of different theoretical models.

**Presentation Type:**

Slides

## The charm of hot matter - charmonium and open charm measurements in Pb-Pb collisions with ALICE at the LHC

**Author:** Anton Andronic<sup>1</sup>

<sup>1</sup> *GSI Darmstadt*

**Corresponding Author:** a.andronic@gsi.de

Among the various suggested probes of deconfinement, charmonium states play a distinctive role.  $J/\psi$  is the first hadron for which a clear mechanism of suppression (melting) in deconfined matter was proposed early on, based on the color analogue of Debye screening. The ALICE measurements of  $J/\psi$  production in Pb-Pb collisions are performed as a function of collision centrality, transverse momentum and rapidity. The nuclear modification factor of  $J/\psi$  production shows that, at the LHC, there is an enhanced relative production at low transverse momentum compared to that at lower energies. Corroborated with the measurements of open charm hadrons, which will also be discussed, the charmonium results hint at a production in a thermalized hot medium. Comparisons to model predictions indicate that  $J/\psi$  production occurs in deconfined matter or at hadronization.

**Presentation Type:**

Invited talk

**Parallel Session II: Heavy Ion Collisions / 34**

## Flow with ALICE

**Author:** Mikolaj Krzewicki<sup>1</sup>

<sup>1</sup> *GSI*

**Corresponding Author:** mikolaj.krzewicki@cern.ch

The expansion of the spatially asymmetric dense and hot medium created in heavy-ion collisions causes, through multiple constituent interactions, correlations between the produced particles. Anisotropic flow, apparent in the azimuthal correlations with respect to the collision symmetry planes is a unique observable associated with the thermodynamic properties and the evolution of the created medium. Elliptic flow, together with the higher order flow coefficients and mixed harmonic correlations, can provide insights into the effects of the event-by-event fluctuations of the initial shape of the produced system. In this talk a range of azimuthal correlation measurements in Pb-Pb collisions at  $\sqrt{s}=2.76$  TeV per nucleon pair measured with the ALICE detector at the LHC will be presented as a function of transverse momentum and collision centrality over a wide (pseudo-) rapidity range for various species of identified hadrons. The results will be compared to hydrodynamic model calculations and to measurements at lower energies.

**Presentation Type:**

oral

**Parallel Session VIII: Heavy Ion Collisions / 35**

## Summary of ALICE at the LHC results from heavy flavour measurements in p-p and Pb-Pb collisions at LHC energies.

**Author:** Zinhle Buthelezi<sup>1</sup>

<sup>1</sup> *iThemba LABS***Corresponding Author:** zinhle@tlabs.ac.za

A Large Ion Collider Experiment (ALICE) is one of the 4 large experiments at the CERN Large Hadron Collider (LHC). The primary purpose of ALICE is to study and characterize the Quark Gluon Plasma (QGP) formed in high-energy nuclear collisions. The capabilities of ALICE include excellent particle identification, wide rapidity coverage, precise vertexing and tracking in a high multiplicity environment, making it possible to study heavy flavour (charm and beauty) production. Heavy flavours are produced at the early stage of the collision in hard partonic scattering. In proton-proton collisions they are used as bench-mark for perturbative QCD calculations while in heavy ion collisions they are used as probes of the transport properties of strongly-interacting matter at high energy density. In ALICE heavy flavours are studied at mid-rapidity via the hadronic and semi-electronic decay channels as well as at forward rapidity using the muon spectrometer. The ALICE collaboration has published results obtained from heavy flavour measurements in p-p at  $\sqrt{s} = 2.76$  and 7 TeV and Pb-Pb collisions at  $\sqrt{s(NN)} = 2.76$ , respectively. In this presentation we will report on some of these results. In particular, we will discuss the observations of high-momentum suppression of azimuthal anisotropy of heavy-flavour hadrons.

**Parallel Session IV: BSM, SUSY, Exotics / 36**

## Search for exotic resonances in diboson final states with the CMS detector at the LHC

**Author:** Flavia de Almeida Dias<sup>1</sup><sup>1</sup> *Sao Paulo State University***Corresponding Author:** flavia.dias@cern.ch

We present the results of searches for new resonances decaying to dibosons (WW, WZ, ZZ) using data collected by the CMS experiment at the LHC. The results are interpreted in benchmark models, such as the Randall-Sundrum gravitons, the Sequential Standard Model  $W'$ , and Technicolor.

**Parallel Session IV: BSM, SUSY, Exotics / 37**

## Search for single and pair production of dijet resonances with the CMS Detector

**Author:** Kai Yi<sup>1</sup><sup>1</sup> *University of Iowa***Corresponding Author:** yik@fnal.gov

We report on a search for single and pair-produced particles in leading two-jet and four-jet final states at CMS, using pp collision data at  $\sqrt{s} = 7$  TeV and 8 TeV provided by the Large Hadron Collider. In the standard model, dijet masses based on leading jets in the central region of CMS should be smoothly distributed. We use this spectrum to search for narrow resonances and set lower limits on the masses of string resonances, excited quarks, axigluons, colorons, S8 resonances, E6 diquarks,  $W'$  and  $Z'$  bosons, and RS gravitons. In four-jet final states, we require closely matched pairs of dijets to search for pair-production of new colored particles decaying to dijets. This channel is also sensitive to pair-produced RPV stop decays.

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## Search for the Standard Model Higgs at the LHC

**Author:** Mayda Velasco<sup>1</sup>

<sup>1</sup> *Northwestern University*

**Corresponding Author:** mvelasco@lotus.phys.northwestern.edu

Results about the experimental searches for the Standard Model Higgs in the decays to fermions and gauge bosons at a collision energy of 7 and 8 TeV at the LHC are presented. The analysis uses pp collision data recorded by the CMS detector at the LHC, corresponding to integrated luminosities of 5.05 fb<sup>-1</sup> at collision energy of 7 TeV and 5.26 fb<sup>-1</sup> at 8 TeV. The searches cover overall Higgs boson mass hypotheses in the range 110 < m<sub>H</sub> < 600 GeV. A complete description of the analyses for the H->gg and H->ZZ->4lepton searches, the most clean and high resolution channels, is provided. The nature of the excess of events observed in those two channels is explained. The general strategy and the final results are shown for the searches of the Higgs boson in the H->WW, H->tautau and H->bb channels. The results for 7 and 8 TeV analyses are combined to derive the best sensitivity of the Higgs searches by the CMS detector at the LHC and the most complete results with 2011 and 2012 data.

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## Searches for Supersymmetry with the CMS detector at the LHC

**Author:** Andrew Askew<sup>1</sup>

<sup>1</sup> *Florida State University*

**Corresponding Author:** askew@hep.fsu.edu

We present the results of searches for Supersymmetry performed using the datasets collected in 2011-2012 by the CMS experiment at the LHC in pp-collisions at center-of-mass energy of 7 and 8 TeV. The results are interpreted in the light of the mSUSM and simplified models.

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## Heavy Ion Physics from the CMS Collaboration

**Author:** Pradeep Sarin<sup>1</sup>

<sup>1</sup> *IIT, Bombay*

**Corresponding Author:** pradeepsarin@cern.ch

The talk presents recent results on collisions involving Pb ions from the CMS Experiment at the LHC. Results include jet quenching and jet modification studies; suppression of the production of J/psi and Y particles and their excited states; electroweak boson production; and global and collective features of heavy ion collisions, such as various distributions and azimuthal asymmetry of the final state charged particles.

## Search for Higgs Decaying to WW at CMS

**Author:** Leonardo di Matteo<sup>1</sup>

<sup>1</sup> *University and INFN Milano-Bicocca*

**Corresponding Author:** leonardo.di.matteo@cern.ch

A search for a standard model Higgs boson decaying into a WW pair is presented, using CMS proton-proton collision data both at 7 TeV and 8 TeV centre-of-mass energy. Both fully-leptonic and semileptonic W decay final states are considered. The combination of these two decay modes is sensitive to the existence of the SM Higgs in the mass range [120, 600] GeV/c<sup>2</sup>.

**Parallel Session XII / 42**

## Performance of the CMS Electromagnetic Calorimeter and Its Role for the Hunt for the Higgs Boson in the 2 Gamma Channel

**Author:** Federico de Guio<sup>1</sup>

<sup>1</sup> *University of Milano-Bicocca and INFN*

**Corresponding Author:** federico.de.guio@cern.ch

The electromagnetic calorimeter of CMS (ECAL) is a hermetic, fine grained and homogeneous calorimeter containing 75848 lead-tungstate (PbWO<sub>4</sub>) crystals, completed by a silicon preshower installed in front of the endcaps. The ECAL sensitivity to decay modes with electromagnetic objects in the final state, such as narrow resonances decaying into two photons, is achieved through its excellent energy and position resolution. The ECAL performance from 2010-2012 is presented in detail and its role in the hunt for the Higgs boson, through the 2-gamma decay mode, is discussed.

**Parallel Session X / 43**

## Studies on B hadron production, spectroscopy and decays at CMS

**Author:** Xin Shi<sup>1</sup>

<sup>1</sup> *National Taiwan University*

**Corresponding Author:** xin.shi@cern.ch

We review several recent results of the CMS experiment in the field of B hadron productions, spectroscopy and decays. A measurement of the  $\Lambda_b$  lifetime using the decay  $\Lambda_b \rightarrow J/\psi \Lambda$  is presented. The dataset was recorded with the CMS detector using a trigger selecting unbiased  $J/\psi$  decaying to dimuons. We performed a flavour-untagged measurement of the width difference  $\Delta\Gamma_s$  in the  $B_s \rightarrow J/\psi \phi$  decays. With an assumption of zero mixing phase, reconstructed  $B_s$  signal candidates are used to measure the polarization amplitudes in an angular and proper decay time analysis.

**Parallel Session X / 44**

## Jet physics and vector boson plus jet physics at CMS

**Author:** Tom Cornelis<sup>1</sup>

<sup>1</sup> *University of Antwerp*

**Corresponding Author:** tom.cornelis@ua.ac.be

We present recent measurements of jet cross sections and their properties, using proton-proton collision data collected with the CMS detector. Measurements of jet production rates in association with W, Z, or photons are also presented. Jet measurements at the LHC can be used to confront predictions of perturbative QCD, are sensitive to new physics signals, and can be used to constrain PDFs.

**Parallel Session VII: BSM, SUSY, Exotics / 45**

## Studies of exotic quarkonium states at CMS

**Author:** Alessandra Fanfani<sup>1</sup>

<sup>1</sup> *University and INFN Bologna*

**Corresponding Author:** fanfani@bo.infn.it

Using large data samples of di-muon events, CMS has performed detailed measurements in the field of exotic quarkonium production. We will present very recent result on the X(3872) exotic state, in the  $J/\psi \pi \pi$  decay channel, based on ~6500 events, collected at  $\sqrt{s} = 7$  TeV, and covering unprecedentedly high values of  $p_T$ . The cross-section ratio w.r.t. the  $\psi(2S)$  will be given differentially in  $p_T$ , as well as  $p_T$  integrated. For the first time at the LHC the fraction of X(3872) coming from B hadron decays has been established. We finish with a measurement of the di-pion mass spectrum to establish details of the nature of the decay. Having opened the field for studies on exotic quarkonium, we will report detailed measurements from one more exotic state.

**Parallel Session V: Quarkonia / 47**

## Latest results on the search for the $D_0 \rightarrow \mu\mu$ and $B_s(B_d) \rightarrow \mu\mu$ decays from CMS

**Author:** Fabrizio Palla<sup>1</sup>

<sup>1</sup> *INFN, Pisa*

**Corresponding Author:** fabrizio.palla@cern.ch

One promising way to search for physics beyond the Standard Model is to look at decay modes that are extremely rare or forbidden, such as the decays of neutral charm and bottom quarks into opposite charge muon pairs. New Physics models can enhance the Standard Model predicted BR by several order of magnitudes. We will report the latest results of the search for  $D_0 \rightarrow \mu\mu$  and  $B_s(B_d) \rightarrow \mu\mu$  using the data collected in 2011 and 2012 by the CMS detector at LHC.

**Parallel Session IX and Student Session / 48**

## Electroweak results from CMS

**Author:** Vitaliano Ciulli<sup>1</sup>

<sup>1</sup> *Università di Firenze and INFN, Firenze*

**Corresponding Author:** vitaliano.ciulli@fi.infn.it

The latest electroweak results from CMS, based on pp collision data taken at 7 and 8 TeV, are presented. In particular precise measurements of the inclusive and differential cross sections for W Z boson production, and for multi-bosons production will be shown.

**Parallel Session XI / 49**

## Top quark pair production cross section at CMS

**Author:** Silvia Costantini<sup>1</sup>

<sup>1</sup> *University of Ghent*

Precision measurements are presented of the top-pair production cross section in proton-proton collisions at the LHC at a centre-of-mass energies of 7 and 8 TeV. The data are collected with the CMS experiment in 2011 and 2012. The measurements are performed in several decay channels, the lepton+jets, the dilepton and the fully hadronic channels, including the tau-dilepton and tau+jets modes. B-jet identification is used to increase the purity of the selection. The backgrounds are determined using data-driven techniques. The results are combined with each other and compared with theory predictions.

**Parallel Session XI / 50**

## Top quark properties

**Author:** Lucia Batkova<sup>1</sup>

<sup>1</sup> *Comenius University in Bratislava*

**Corresponding Author:** lucia.batkova@gmail.com

Properties of the top quark are measured with the ATLAS detector using LHC proton-proton collisions data. Measurements of the top-quark mass and charge, as well as of the polarization of W bosons in top quark decays to probe the Wtb-vertex are presented. In addition, measurements of the spin correlation between top and anti-top quarks as well as of the top-quark charge asymmetry, which constitute important tests of QCD and are sensitive to new physics, are discussed. The search for flavour changing neutral current processes in top quark decays is reviewed.

**Parallel Session XI / 51**

## Top Quark production

**Author:** Danilo Enoque Ferreira de Lima<sup>1</sup>

<sup>1</sup> *University of Glasgow*

Measurements of the top quark production cross sections in proton-proton collisions with the ATLAS detector at the Large Hadron Collider are presented. The measurement require no, one or two electrons or muons in the final state (single lepton, dilepton, hadronic channel). In addition, the decay modes with tau leptons are tested (channels with tau leptons). The main focus are measurements

of differential spectra of  $t\bar{t}$  final states, in particular, measurements that are able to constrain the modelling of additional parton radiation. Measurements of single top-quark production in the  $t$ - and  $Wt$ -channels are presented and determination of the CKM matrix element  $|V_{tb}|$  is discussed. In addition, the  $s$ -channel production is explored and limits on exotic production in single top quark processes are discussed. This also includes the search for flavor changing neutral currents and the search for additional  $W'$  bosons in the  $s$ -channel.

**Parallel Session V: Quarkonia / 52**

## **Production of beauty and quarkonia in ATLAS: transverse momenta spectra, prompt and non-prompt production, spectroscopy**

**Author:** Tomas Jacoubek<sup>1</sup>

<sup>1</sup> *Institute of Physics Academy of Sciences of the Czech Republic*

**Corresponding Author:** tomas.jakoubek@cern.ch

Measurements of quarkonia and open heavy-flavor states at the LHC can often probe the available predictions. ATLAS has measured the production cross section of prompt and non-prompt  $J/\Psi$  as well as  $Y(1,2,3 S)$ , together with the inclusive production of  $b$ -flavored hadrons. The kinematical ranges covered by these analyses probes higher transverse momenta than previous studies. The results are in some cases marginally compatible with the latest available predictions. Excited  $B$ -hadrons and quarkonia states have also been detected with the ATLAS detector, further expanding the investigation in the field of  $b$ -hadron and onia spectroscopy. The latest results, which include the observation of new particles, will be illustrated together with the perspectives for future analyses.

**Parallel Session XIV / 53**

## **Searches for supersymmetry in resonance production, R-parity violating signatures and events with long-lived particles with the ATLAS detector**

**Author:** Helen Hayward<sup>1</sup>

<sup>1</sup> *University of Liverpool*

**Corresponding Author:** hayward@hep.ph.liv.ac.uk

An extended QCD sector beyond the minimal supersymmetric standard model or the admission of R-parity violation introduces new signatures to the search for supersymmetry at the LHC. Strongly interacting resonances may decay to jets, sleptons may decay via lepton-flavour violating processes and lightest supersymmetric particles may decay into many leptons with or without missing transverse momentum. Several supersymmetric models also predict massive long-lived supersymmetric particles. Such particles may be detected through abnormal specific energy loss, appearing or disappearing tracks, displaced vertices, long time-of-flight or late calorimetric energy deposits. The talk presents recent results from searches supersymmetry in resonance production, R-parity violating signatures and events with long-lived particles with the ATLAS detector.

**Parallel Session VII: BSM, SUSY, Exotics / 54**



## Searches for natural supersymmetry with the ATLAS detector

**Author:** Mark Hodgkinson<sup>1</sup>

<sup>1</sup> *University of Sheffield*

**Corresponding Author:** m.hodgkinson@sheffield.ac.uk

Naturalness arguments for weak-scale supersymmetry favour supersymmetric partners of the third generation quarks, Higgs and electroweak gauge bosons with masses not too far from those of their Standard Model counterparts. Real and virtual production of third generation squarks via decay of a gluino can be significant if the mass of the gluino does not exceed the TeV scale. Top or bottom squarks as well as gauginos and sleptons with masses less than a few hundred GeV can also give rise to direct pair production rates at the LHC that can be observed in the data sample recorded by the ATLAS detector in 2011 and 2012. The talk presents recent ATLAS results from searches for gluino mediated and direct stop and sbottom pair production in various final states, and for electroweak production of gauginos and sleptons in final states with leptons.

**Parallel Session VII: BSM, SUSY, Exotics / 55**

## Inclusive searches for squarks and gluinos with the ATLAS detector

**Author:** Valerio Consorti<sup>1</sup>

<sup>1</sup> *Albert-Ludwigs-Universitaet Freiburg (DE)*

**Corresponding Author:** valerio.consorti@cern.ch

Despite the absence of experimental evidence, weak scale supersymmetry remains one of the best motivated and studied Standard Model extensions. This talk summarizes recent ATLAS results on inclusive searches for supersymmetric squarks and gluinos in events containing jets, missing transverse momentum with and without leptons of all generations and photons.

**Parallel Session XIV / 57**

## Search for Exotics new particles with the ATLAS detector

**Author:** John Almond<sup>1</sup>

<sup>1</sup> *University of Manchester*

**Corresponding Author:** jalmond@cern.ch

Various extensions of the Standard Model predict the existence of new types of particles. We report on several searches for exotics new particles such as: excited lepton, adjunction of a 4th family of heavy chiral fermions, vector-like quarks that couple to light quarks and Z or W bosons. The talk presents recent results with data collected by the ATLAS experiment at the LHC.

**Parallel Session IV: BSM, SUSY, Exotics / 58**

## Search for Exotics heavy resonances with the ATLAS detector

**Author:** Simon Viel<sup>1</sup>

<sup>1</sup> *University of British Columbia*

**Corresponding Author:** sviel@cern.ch

Resonances decaying into a pair of particles are an obvious place to look for phenomena beyond the Standard Model. This talk summarizes wide collection of recent results on searches for resonances decaying to pairs of jets including top antitop, leptons including taus and dibosons. Variety of Beyond the Standard Model are considered, among them GUT models, the Randall-Sundrum gravitons as well as the ADD large extra dimension scenario and Technicolor.

**Parallel Session IX and Student Session / 59**

## **ATLAS measurements of vector boson and diboson production**

**Author:** William Buttinger<sup>1</sup>

<sup>1</sup> *University of Cambridge*

**Corresponding Author:** will@cern.ch

Vector boson production in pp collisions at 7 TeV has been extensively studied by ATLAS. Recent results include the measurement of Drell-Yan differential production cross section and of jets and heavy flavours production in association with vector bosons. ATLAS measurements of diboson production processes involving all combinations of W and Z are also summarized. Differential and total visible cross sections are presented and are used to place constraints on anomalous triple-gauge boson couplings.

**Parallel Session VI: Standard Model Higgs / 60**

## **Search for the Standard Model Higgs boson in the $H \rightarrow \text{GammaGamma}$ , $H \rightarrow \text{WW}$ and $H \rightarrow \text{ZZ}$ decay modes with the ATLAS detector**

**Author:** German David Carrillo Montoya<sup>1</sup>

<sup>1</sup> *University of the Witwatersrand*

**Corresponding Author:** montoya@cern.ch

A Higgs boson search in the  $H \rightarrow \text{GammaGamma}$ ,  $H \rightarrow \text{WW} \rightarrow \text{l}\nu\text{l}\nu$  and  $H \rightarrow \text{ZZ} \rightarrow 4\text{l}$  decay modes has been performed using proton-proton collisions collected in 2011 and 2012 with the ATLAS detector. Updated results on the observed resonance including first measurement of its properties are presented.

**Parallel Session VI: Standard Model Higgs / 61**

## **Search for the Standard Model Higgs boson produced decaying to a b-quark pair and Tau-lepton pair with the ATLAS detector**

**Author:** Ada Farilla<sup>1</sup>

<sup>1</sup> *INFN Roma Tre***Corresponding Author:** ada.farilla@roma3.infn.it

The results of the ATLAS search for the Standard Model Higgs boson decaying to a b-quark pair and Tau-lepton pair are presented, based on the proton-proton collision data recorded in 2011 and 2012. Upper limits on the cross-section times branching ratio are derived.

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## SM Higgs searches with the ATLAS experiment at the LHC

**Author:** Rachid Mazini<sup>1</sup><sup>1</sup> *Institute of Physics, Academia Sinica Taiwan***Corresponding Author:** rachid.mazini@cern.ch

The latest results of the Standard Model Higgs boson search with the ATLAS experiment, in pp collisions data collected in 2011 and 2012 are presented. Individual search channels, as well as their combination are detailed. The significance of the observed excess of the Higgs-like resonance are updated and presented. Preliminary results from the measurement of the properties of the Higgs-like particle are presented.

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## Statistics for Higgs search and discovery

**Author:** Eilam Gross<sup>1</sup><sup>1</sup> *Weizmann Institute of Science***Corresponding Author:** eilam.work@gmail.com

The LHC statistical method is based on the Profile Likelihood test statistics and its asymptotic formalism. In this lecture the statistical methods (including the so called Look Elsewhere Effect) and their implications on the Higgs search and discovery at the LHC will be reviewed.

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## Standard Model and Top Physics with ATLAS

**Author:** Killian Rosbach<sup>1</sup><sup>1</sup> *Université de Genève, DPNC***Corresponding Author:** kilian.rosbach@cern.ch

The ATLAS collaboration has performed studies of a wide range of Standard Model physics processes in pp collisions. Recent measurements of soft particle to hard photon and jet production, which are sensitive to QCD phenomena, are presented. Drell-Yan, vector boson and diboson production cross sections are also discussed, together with constraints on anomalous triple-gauge boson couplings. Inclusive cross-section measurements for top-quark pair and single top t- and Wt-channels are shown. For top-quark pair production, emphasis is given to differential measurements and additional radiation studies, including also spin correlation and top-quark charge asymmetry. Intrinsic top quark

properties as its mass and charge as well as a measurement of the polarization of W bosons in top quark decays are also presented.

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## Overview of results from the ALICE Experiment at the CERN LHC

**Author:** Yiota Foka<sup>1</sup>

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ALICE, designed as a general purpose heavy-ion detector for the CERN Large Hadron Collider has been successfully running for the last three years. Data from pp collisions have been collected at different centre of mass energies, including 0.9, 2.76 and 7 TeV and from Pb-Pb collisions at 2.76 TeV per nucleon. The data analysis shows intriguing properties of the produced matter in Pb-Pb collisions. The results indicate that the created system is larger, hotter and denser compared to the one created in heavy-ion collisions at lower energies and it still behaves like a perfect, strongly interacting liquid. A review of recent ALICE results will be presented.

**Parallel Session IX and Student Session / 67**

## First direct observation of time reversal violation in the B system and new CPV results from BABAR

**Author:** Franco Simonetto<sup>1</sup>

<sup>1</sup> *Universita & INFN Padova*

While CP violation in the B-meson system has been well established by the B factories, there has been no direct observation of time-reversal violation in this system. Furthermore, previous T-violation measurements in other systems are typically not able to distinguish between T and CP violation. Using 468 million B-Bbar pairs collected by the BABAR detector at SLAC, we directly measure T-violating parameters in the time evolution of neutral-B mesons by comparing the probabilities of B<sub>0</sub> or anti-B<sub>0</sub> transforming into definite CP final states and vice versa. The results lead to the first direct, high-significance observation of Time Reversal non-invariance, independent of CP violation. We also present new and precise measurements of the CKM angle alpha and the CP-violation parameter  $|q/p|$ .

**Parallel Session III: Theory / 68**

## An effective model description of QCD thermodynamics

**Author:** Ludwik Turko<sup>1</sup>

<sup>1</sup> *Institute of Theoretical Physics, University Wroclaw*

**Corresponding Author:** [lturko@ift.uni.wroc.pl](mailto:lturko@ift.uni.wroc.pl)

An effective model reproducing the equation of state of hadronic matter as obtained in lattice QCD simulations basic is constructed. The model is based on the Mott-Hagedorn resonance gas approach

and extended PNJL model. All basic physical characteristics of processes encountered in the dense hadronic matter are taken into account.

#### Parallel Session VIII: Heavy Ion Collisions / 69

### The long-wavelength limit of the Boltzmann equation: recent insights in deriving dissipative relativistic fluid dynamics

**Author:** David Rischke<sup>1</sup>

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In this talk (based on arXiv:1202.4551 [nucl-th]), I present a new derivation of dissipative relativistic fluid dynamics from the Boltzmann equation via the method of moments. In contrast to previous derivations, the single-particle distribution function is not subjected to a truncation in an uncontrolled way. Instead, it is expanded in terms of irreducible tensors in momentum-space and orthogonal polynomials in energy. The infinite system of moment equations, which is equivalent to the Boltzmann equation, can then be truncated in a controlled way by considering only the slowest microscopic time scale and a rigorous power-counting in Knudsen and inverse Reynolds numbers. I demonstrate that agreement with microscopic solutions of the Boltzmann equation for specific test problems can be improved by going beyond the traditional 14-moment approximation

#### Parallel Session XII / 70

### Turning on the Charm

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I will argue that in heavy-ion collisions the observed strong quenching of heavy quark flavors at intermediate momenta has a sizable contribution from binary scatterings in the quark-gluon plasma. To arrive at this conclusion, I go beyond existing approaches in two aspects: (i) by calculating the collision probability beyond leading-log accuracy, taking into account the momentum dependence of the strong coupling, and (ii) using this probability as the basis of a consistent transport description of heavy flavors, formulating their evolution as a Markov process.

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### Lessons from LHC8

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## LHC Status

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**Parallel Session I: BSM, Exotics / 73**

## Search for the neutral supersymmetric Higgs boson at CMS

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**Parallel Session III: Theory / 75**

## Is it Hard yet? The qualitative agreement of pQCD energy loss with RHIC and LHC data

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High momentum particles provide the most direct probe of the pertinent physics of the quark-gluon plasma produced at RHIC and LHC. We present comparisons of the latest pQCD- and AdS/CFT-based energy loss models with the newest high momentum measurements from RHIC and LHC. In contrast to the naive success of strong coupling AdS/CFT methods in describing the very small viscosity to entropy ratio extracted from hydrodynamics studies, the qualitative agreement of the weak-coupling and the disagreement of the strong-coupling calculations compared to high momentum observables suggest that the dominant quark-gluon plasma physics is best described using perturbative QCD methods. Future measurements may hold the key to understanding this potential crossover between strong and weak coupling dynamics.

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## The deconfinement of Charm and Beauty

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## **Testing the Standard Model with rare decays at the LHCb**

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## **Review of results from the Tevatron**

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## **Beam Energy Scan (BES) at STAR**

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## **Heavy Ion Physics with ATLAS**

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## **Search for Physics beyond the Standard Model with the ATLAS detector**

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## **New Results from CMS**

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**Parallel Session VII: BSM, SUSY, Exotics / 83**

## **Search for the Standard Model Higgs at CMS in the 4 Lepton Channel**

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**Parallel Session VIII: Heavy Ion Collisions / 84**

## **Hadronic Resonance Production in pp and pb-pb collisions at the LHC with the ALICE experiment**

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## **Phase Structure of Strongly Interacting Matter**

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## **The NICA Project**

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## **CP violation at LHCb**

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**Parallel Session X / 88**

## **The Tsallis Distribution at the LHC**

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**Parallel Session XI / 89**

## **The Physics Case for the LHeC**

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## **Highlights from STAR**

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## **QCD in Astrophysics**

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**Parallel Session XIII / 92**

## **RHIC and LHC heavy ion collisions with pQCD Boltzmann transport**

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Over the years a microscopic transport description for modeling the parton dynamics of ultrarelativistic heavy ion collisions at RHIC and at LHC has been developed. The parton cascade BAMPS is based on the solution of the relativistic Boltzmann equation treating perturbative QCD (pQCD) elastic and inelastic bremsstrahlung interactions. Collective effects of the evolving fireball, the depletion of jets by the partonic medium as well as the production and propagation of heavy quarks and heavy quarkonia can be thoroughly investigated within this unified approach. Fast thermalization and a strong buildup of elliptic flow can be understood emerging from the pQCD interactions and has to be contrasted with the ideal liquid sQGP. Most recently, the employed Gunion-Bertsch inelastic collision cross sections are challenged in comparison to the full pQCD inelastic matrix elements and will be discussed. Finally the production, the suppression and the elliptic flow of heavy quarks in line of the new experimental data at LHC will be considered and presented.

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## **Welcome Function on the banks of the Sabie River with Shangaan dancers and choir**

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## **Welcome**

**Parallel Session V: Quarkonia / 95**

## **J/Psi Production in the ALICE detector**

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**Parallel Session IX and Student Session / 96**

## **Evolution of Yukawa Coupling and Quark Flavor Mixings in the 5D MSSM**

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**Parallel Session IX and Student Session / 97**

## **Z' boson decay to di-muon final states**

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**Parallel Session IX and Student Session / 98**

## **Baryon-Omega Meson Electroproduction**

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## **Strangeness from GeV to TeV**

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**Parallel Session XIV / 100**

## **Evidence for an excess of B to D(\*) tau nu decays at BABAR**

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