

From Higgs to Dark Matter 2014, Geilo

Report of Contributions

Contribution ID: 0

Type: **not specified**

Constraining Inert Triplet Dark Matter by the LHC and FermiLAT

Tuesday, 16 December 2014 18:20 (20 minutes)

We study collider phenomenology of inert triplet scalar dark matter at the LHC. We discuss possible decay of Higgs boson to dark matter candidate and apply current experimental data for invisible Higgs decay and $R_{\gamma\gamma}$ to constrain parameter space of our model. We also investigate constraints on dark matter coming from forthcoming measurement, $R_{Z\gamma}$ and mono-Higgs production. We analytically calculate the annihilation cross section of dark matter candidate into 2γ and $Z\gamma$ and then use FermiLAT data to put constraints on parameter space of Inert Triplet Model. We found that this limit can be stronger than the constraints provided by LUX experiment for low mass DM.

Primary author: Dr AYAZI, Seyed Yaser (IPM)

Presenter: Dr AYAZI, Seyed Yaser (IPM)

Session Classification: Indirect Dark Matter Searches

Contribution ID: 1

Type: **not specified**

Looking for dark matter in exotic Higgs decays at the LHC

Tuesday, 16 December 2014 16:05 (20 minutes)

The particle nature of dark matter is one of the most intriguing questions in particle physics. The discovery of a fundamental scalar particle compatible with the Higgs boson predicted by the SM paves the way for probing this question with new methods. An overview of the LHC Run-I legacy results in looking for both exotic Higgs decays with dedicated searches and invisible Higgs decays is presented in this contribution. Interpretations in terms of dark matter searches are discussed and prospects for Run-II searches are overviewed.

Primary author: COCCARO, Andrea (University of Washington (US))

Presenter: COCCARO, Andrea (University of Washington (US))

Session Classification: The Higgs, Dark Matter and Cosmology

Contribution ID: 2

Type: **not specified**

B-factory searches for light scalars and other new states

Tuesday, 16 December 2014 15:45 (20 minutes)

New Higgs scalars with masses up to 10 GeV are predicted in models such as NMSSM, and in scenarios with hidden sectors that couple weakly to the Standard Model. Searches at B factories have resulted in tight constraints on such models. The talk will cover the recent searches and new results, and discuss the future outlook for this physics.

Primary authors: Prof. SOFFER, Abner (Tel Aviv University); BARLOW, Roger (University of Huddersfield (GB))

Presenter: Prof. BARLOW, Roger (MANCHESTER UNIVERSITY)

Session Classification: The Higgs, Dark Matter and Cosmology

Contribution ID: 3

Type: **not specified**

Interplay of LHC and dark matter searches in the MSSM

Monday, 15 December 2014 17:35 (40 minutes)

The Minimal Supersymmetric extension of the Standard Model (MSSM) provides suitable candidates for Dark Matter. In this talk, I will discuss the constraints from Dark Matter direct detection, Planck results and LHC SUSY, Higgs and monojet data, and show that complementary of the different sectors is of importance to probe the pMSSM parameter space.

Primary author: ARBEY, Alexandre (Lyon U.)

Presenter: ARBEY, Alexandre (Lyon U.)

Session Classification: Dark Matter and the LHC

Contribution ID: 4

Type: **not specified**

SUSY DM: ATLAS Discovery Potential for 2015

Monday, 15 December 2014 18:40 (20 minutes)

We scan the 19 parameter pMSSM in search of experimentally viable models which can potentially be discovered by ATLAS during Run 2.

Primary authors: LIPNIACKA, Anna (University of Bergen (NO)); MARTINDITLATOUR, Bertrand (University of Bergen (NO)); SANDAKER, Heidi (University of Bergen (NO)); LINDROOS, Jan Oye (University of Bergen (NO)); Dr BURGESS, Thomas (University of Bergen (NO))

Presenter: LINDROOS, Jan Oye (University of Bergen (NO))

Session Classification: Dark Matter and the LHC

Contribution ID: 5

Type: **not specified**

SM Higgs measurements and prospects

Monday, 15 December 2014 09:10 (40 minutes)

A detailed review of the latest results on the main properties of the Higgs boson using approximately 25 fb⁻¹ of pp collision data collected at 7 TeV and 8 TeV in 2011 and 2012, will be given. The measurements of the mass, couplings properties and main quantum numbers will be presented. Prospects for the next LHC Run starting in 2015 will be reviewed.

Primary author: ASSAMAGAN, Ketevi Adikle (Brookhaven National Laboratory (US))

Presenter: ASSAMAGAN, Ketevi Adikle (Brookhaven National Laboratory (US))

Session Classification: The State of the Higgs

Contribution ID: 6

Type: **not specified**

The Higgs Portal

Tuesday, 16 December 2014 09:00 (40 minutes)

I will discuss some aspects of the Higgs portal models, in particular, their cosmological implications as well as possible signatures at the LHC.

Primary author: LEBEDEV, Oleg (University of Helsinki)

Presenter: LEBEDEV, Oleg (University of Helsinki)

Session Classification: Higgs Portal Models

Contribution ID: 7

Type: **not specified**

Three Higgs doublet models with S3 symmetry and dark matter candidates

Monday, 15 December 2014 16:25 (20 minutes)

I shall report on work in progress in the framework of three Higgs doublets with an S3 symmetry providing a dark matter candidate. This is still very preliminary and I shall focus on the main questions we want to address.

Primary author: REBELO, Margarida Nesbitt (Instituto Superior Tecnico (IST))

Presenter: REBELO, Margarida Nesbitt (Instituto Superior Tecnico (IST))

Session Classification: Multi-Higgs Models

Contribution ID: 8

Type: **not specified**

Inflationary Imprints on Dark Matter

Tuesday, 16 December 2014 16:45 (20 minutes)

A generic feature of Standard Model extensions with no drastic modifications to the Higgs potential is that the Higgs is a light and energetically subdominant field during inflation. Inflationary fluctuations generically displace the field from its vacuum generating a primordial Higgs condensate. This sets specific out-of-equilibrium initial conditions for the hot big bang epoch which could have significant observational ramifications. In this work we investigate how these initial conditions set by inflation affect the generation of dark matter in the class of portal scenarios where SM fields feel new physics only through Higgs mediated couplings. As a representative example we will consider a Z_2 symmetric scalar singlet s coupled to Higgs by $V = \lambda \Phi^\dagger \Phi s^2$. This simple extension has interesting consequences as the singlet constitutes a dark matter candidate originating from non-thermal production of singlet particles out from a singlet condensate.

Summary

Inflation generates specific out-of-equilibrium initial conditions for the hot big bang epoch which could have significant consequences both on dark matter production and other phenomena.

Primary author: Mr TENKANEN, Tommi (University of Helsinki and Helsinki Institute of Physics)

Co-authors: Dr TUOMINEN, Kimmo (University of Helsinki and Helsinki Institute of Physics); Dr NURMI, Sami (University of Helsinki and Helsinki Institute of Physics)

Presenter: Mr TENKANEN, Tommi (University of Helsinki and Helsinki Institute of Physics)

Session Classification: The Higgs, Dark Matter and Cosmology

Contribution ID: 9

Type: **not specified**

Scalar dark matter and possible implications at the LHC

Monday, 15 December 2014 16:05 (20 minutes)

I shall review an extension of the Inert Dark Matter model, that also allows for CP violation in the scalar sector. This kind of model contains charged scalars that could be produced at the LHC, and emit SM particles via virtual W or Z emission in its decay to dark matter.

Primary author: Prof. OSLAND, Per (University of Bergen (NO))

Presenter: Prof. OSLAND, Per (University of Bergen (NO))

Session Classification: Multi-Higgs Models

Contribution ID: 10

Type: **not specified**

Explaining a CMS dilepton excess with the MSSM golden cascade

Tuesday, 16 December 2014 10:35 (20 minutes)

Recently CMS reported a small excess in a search for opposite-sign same-flavor leptons produced in conjunction with two jets and missing transverse momentum. The excess was found to be consistent with a kinematic edge in the invariant mass spectrum of the leptons. We present a possible interpretation of this excess in terms of squark pair production followed by a 'golden cascade' decay for one of the squarks, producing the edge in the dilepton spectrum. We identify models that fit the observed event rate while still passing other collider constraints, and present predictions for the production cross section at 13 TeV. Some of the identified models also predict a relic density of neutralino dark matter compatible with the value inferred from cosmological observations.

Primary author: KVELLESTAD, Anders (University of Oslo)

Presenter: KVELLESTAD, Anders (University of Oslo)

Session Classification: Dark Matter and the LHC

Contribution ID: 11

Type: **not specified**

Search for Scalar Charm Pair Production with the ATLAS Detector in pp Collisions at $\sqrt{s} = 8$ TeV

Monday, 15 December 2014 16:45 (20 minutes)

Supersymmetry (SUSY) is a theoretically attractive extension to the Standard Model of particle physics with the potential to solve several of its theoretical problems. For instance, the nature and production of dark matter is explained in SUSY by the existence of new stable, weakly interacting particles. A search for the production of supersymmetric partners of the charm quark will be presented, using data collected in 2012 with the ATLAS detector at the LHC. This is a previously unexplored SUSY scenario, the search for which makes use of recent developments in charm tagging algorithms and charm-tags the leading two jets in an event, significantly enhancing the sensitivity for this signal over inclusive searches. The results are used to set limits on the visible cross section of new physics, and are interpreted in a specific simplified model with only supersymmetric charm quarks and the neutralino LSP (lightest SUSY particle) kinematically accessible at the LHC.

Primary authors: Prof. BARR, Alan (University of Oxford (GB)); GUEST, Daniel Hay (Yale University (US)); KALDERON, William (University of Oxford (GB))

Co-authors: DAFINCA, Alexandru (University of Oxford (GB)); HENRICHS, Anna (Yale University (US)); GWENLAN, Claire (University of Oxford (GB)); TIPTON, Paul Louis (Yale University (US)); GOLLING, Tobias (Universite de Geneve (CH))

Presenter: KALDERON, William (University of Oxford (GB))

Session Classification: Multi-Higgs Models

Contribution ID: 12

Type: **not specified**

Overview of dark matter searches at CMS

Monday, 15 December 2014 18:20 (20 minutes)

This talk reviews the latest Dark Matter (DM) results from the CMS experiment, consisting in searches for DM particles under the form of Weakly Interactive Massive Particles. The search for directly produced DM particles exploits final states containing a high momentum single object and missing transverse energy, such as monojet, monophoton, monolepton and monotop. The production of DM particles in association with top quarks is also considered. Finally, the search for invisible decays of the Higgs bosons and their DM results are mentioned as well.

Primary author: PAKTINAT MEHDIABADI, Saeid (School of Particles and Accelerator Inst. for Res. in Fundam. S)

Presenter: PAKTINAT MEHDIABADI, Saeid (School of Particles and Accelerator Inst. for Res. in Fundam. S)

Session Classification: Dark Matter and the LHC

Contribution ID: 13

Type: **not specified**

Extending 2HDM by a singlet scalar field - the case for dark matter

Monday, 15 December 2014 15:45 (20 minutes)

We extend the two-Higgs doublet models of Type I and Type II by adding a real gauge-singlet scalar S which is the Dark Matter (DM) candidate (2HDMS models). We impose theoretical constraints derived from perturbativity, stability, unitarity and correct electroweak symmetry breaking and require that the lightest CP-even Higgs, h , fit the LHC data for the ~ 125.5 GeV state at the 68% C.L. after including existing constraints from LEP and B physics and LHC limits on the heavier Higgs bosons. We find that these models are easily consistent with the LUX and SuperCDMS limits on DM-Nucleon scattering and the observed DM abundance for S masses above about 55 GeV. At lower m_S , the situation is more delicate. For points with m_S in the 6 – 25 GeV range corresponding to the CDMS II and CRESST II positive signal ranges, the DM-Nucleon cross sections predicted by the Type I and Type II models more or less automatically fall within the 95% – 99% C.L. signal region boundaries. Were it not for the LUX and SuperCDMS limits, which exclude all (almost all) such points in the case of Type I (Type II), this would be a success for the 2HDMS models. In fact, in the case of Type II there are a few points with $5.5 \text{ GeV} < m_S < 6.2 \text{ GeV}$ that survive the LUX and SuperCDMS limits and fall within the CDMS II 99% C.L. signal region. Possibilities for dark matter to be isospin-violating in this 2HDMS context are also examined.

Primary authors: DROZD, Aleksandra (King's Coll. London); GRZADKOWSKI, Bohdan (University of Warsaw); GUNION, John F. (UC, Davis); JIANG, Yun (UC, Davis)

Presenter: GRZADKOWSKI, Bohdan (University of Warsaw)

Session Classification: Multi-Higgs Models

Contribution ID: 14

Type: **not specified**

High-energy gamma-ray astronomy and dark matter searches with Imaging Air Cherenkov observatories: Status and prospects

Tuesday, 16 December 2014 19:00 (40 minutes)

In recent years, ground-based very-high energy ($E > 50$ GeV) gamma-ray instruments like H.E.S.S., MAGIC, and VERITAS have taken on a major role in high-energy astrophysics. The high sensitivity and performance parameters, still far from the limits of the observation technique though, have led to the detection and enabled studies of more than 100 sources of various source populations. The instruments are also well suited for the indirect searches for dark matter and have conducted major search programs in the last years. Building on their success, Cherenkov Telescope Array (CTA) is a project for a next-generation observatory for very high energy (GeV-TeV) ground-based gamma-ray astronomy, currently in its design phase, and foreseen to be operative a few years from now. In the talk, the observation technique and current status of the field is reviewed and selected recent scientific results are highlighted. I will also review the status of dark matter searches and prospects for CTA.

Primary author: WAGNER, Robert (Stockholm University)

Presenter: WAGNER, Robert (Stockholm University)

Session Classification: Indirect Dark Matter Searches

Contribution ID: 15

Type: **not specified**

Ultra high-energy cosmic rays: present and future

Tuesday, 16 December 2014 16:25 (20 minutes)

Recent progress on the field of ultra high-energy cosmic rays (UHECR) has been driven by the data collected by the Pierre Auger Observatory in the southern hemisphere and by Telescope Array (TA) in the northern hemisphere. These hybrid observatories combine large ground arrays with fluorescence detection techniques. In this presentation, selected results from Auger and TA will be reviewed. Challenges and prospects for the future will then be addressed.

Primary author: ESPIRITO SANTO, Catarina (LIP)

Presenter: ESPIRITO SANTO, Catarina (LIP)

Session Classification: The Higgs, Dark Matter and Cosmology

Contribution ID: 16

Type: **not specified**

Antideuterons from Dark Matter and Hadronization uncertainties

Tuesday, 16 December 2014 18:40 (20 minutes)

Due to its low astrophysical background, the antideuteron channel is a highly promising channel for indirect detection of dark matter.

Being an antinucleus, the antideuteron flux has additional uncertainties from the nucleus formation model that are not relevant for other indirect detection channels.

The antideuteron formation model depends on very small momentum differences between antinucleons, making it highly sensitive to two-particle correlations arising from the hadronization models employed by Monte Carlo event generators.

I will here discuss the influence of hadronization on antideuteron formation, and the uncertainty on the antideuteron flux this leads to.

I will further discuss the prospects of reducing this uncertainty by tuning Monte Carlo generators specifically for antideuteron production.

Primary author: DAL, Lars Andreas (University of Oslo)

Presenter: DAL, Lars Andreas (University of Oslo)

Session Classification: Indirect Dark Matter Searches

Contribution ID: 17

Type: **not specified**

Dark matter, cosmic rays and the Higgs boson : an update

Tuesday, 16 December 2014 17:35 (40 minutes)

Although the existence of the astronomical dark matter is by now well established, its nature is still unresolved. The favoured candidate is a massive and weakly interacting neutral particle, dubbed WIMP, whose relic abundance is compatible with cosmological measurements. If present inside the haloes of galactic systems, these species still annihilate and yield distortions in the various cosmic radiations which a plethora of experiments are searching with increasing accuracy.

I will review the status of the current searches. In particular, I will discuss the recently confirmed high-energy positron anomaly as well as the yet unexplained GeV gamma-ray excess from the Galactic center. Antiprotons yield also severe bounds on WIMP properties which may turn out to be crucial. I will finally elaborate on the still remote connections between dark matter indirect searches and the Higgs boson.

Primary author: SALATI, PIERRE (LAPTh and Université de Savoie)

Presenter: SALATI, PIERRE (LAPTh and Université de Savoie)

Session Classification: Indirect Dark Matter Searches

Contribution ID: 18

Type: **not specified**

First order electroweak phase transition and dark matter in (non)conformal Higgs portal models

Tuesday, 16 December 2014 09:45 (20 minutes)

We study the electroweak phase transition in class of classically (non)conformal Higgs portal models, with and without Veltman conditions imposed for the scalar sector. Some of the models include also fermionic type dark sector, which can be related to dark matter or neutrino masses.

We find, by scanning the model parameter spaces, many realizations of the models, where the electroweak phase transition is strongly first order. The portal coupling is usually large in these cases, and particularly the Veltman conditions reduce suitable parameter space significantly. We impose constraints for the models, analyse the aspects of the fermionic dark sectors, and discuss about further analysis prospects.

Primary authors: VIRKAJÄRVI, Jussi (urn:Google); SANNINO, francesco (CP3-Origins)

Presenter: VIRKAJÄRVI, Jussi (urn:Google)

Session Classification: Higgs Portal Models

Contribution ID: 19

Type: **not specified**

Minimal models for decaying Dark Matter and the LHC

Monday, 15 December 2014 19:00 (40 minutes)

We introduce minimal models of decaying Dark Matter, characterized by the fact that DM interacts with SM particles through one renormalizable coupling with an additional heavier SM charged state. Such interaction allows to produce a substantial abundance of DM in the early Universe via the decay of the charged heavy state, either in- or out-of-equilibrium. Moreover additional couplings of the charged particle open up decay channels for the DM, which can nevertheless be sufficiently long-lived to be a good DM candidate and within reach of future Indirect Detection observations. We discuss possible signals at the LHC

in the cosmologically favored parameter region and comment on the possibility to obtain in such models the recently observed 3.55 keV X-ray line.

Primary author: COVI, Laura (Goettingen University)

Presenter: COVI, Laura (Goettingen University)

Session Classification: Dark Matter and the LHC

Contribution ID: 20

Type: **not specified**

Constraints on Dark Matter from ATLAS mono-X + missing energy searches

Tuesday, 16 December 2014 10:55 (20 minutes)

The ATLAS experiment at CERN performs several dedicated searches for Dark Matter production, using mono-jet plus missing energy signals and mono-X plus missing energy where X can be for instance a W or Z boson or a photon. The latest constraints on Dark Matter from these searches are presented and include limits derived from search for Higgs to invisible decays.

Primary author: CLEMENT, Christophe (Stockholm University (SE))

Presenter: CLEMENT, Christophe (Stockholm University (SE))

Session Classification: Dark Matter and the LHC

Contribution ID: 21

Type: **not specified**

On the way to the Dark Matter simplified models for Run-2

Tuesday, 16 December 2014 11:15 (20 minutes)

Both ATLAS and CMS have been using effective field theory approach to describe their results in terms of the DM pair-production in Run-1. Whereas the effective field theory is well applicable in the case of the direct detection experiments, it is facing severe criticism when used at colliders where the actual inferred limits on the suppression scale are comparable to the centre-of-mass energy. I will report on the recent works and on the ongoing effort to define a set of simplified models that ATLAS and CMS shall be using in Run-2.

Primary author: SALEK, David (NIKHEF (NL))

Presenter: SALEK, David (NIKHEF (NL))

Session Classification: Dark Matter and the LHC

Contribution ID: 24

Type: **not specified**

Higgs measurements and global fits

Tuesday, 16 December 2014 15:00 (40 minutes)

Presenter: BECHTLE, Philip (Deutsches Elektronen Synchrotron (DESY))

Session Classification: The Higgs, Dark Matter and Cosmology

Contribution ID: 25

Type: **not specified**

The two Higgs doublet model with and without dark matter

Monday, 15 December 2014 15:00 (40 minutes)

Presenter: STÅL, Oscar (DESY)

Session Classification: Multi-Higgs Models

Contribution ID: 26

Type: **not specified**

Gamma Rays from Dark Matter Self-annihilations and Black Holes

Wednesday, 17 December 2014 09:20 (40 minutes)

Presenter: SILK, joseph (IAP)

Session Classification: Indirect Dark Matter Searches

Contribution ID: 27

Type: **not specified**

Overview of BSM Higgs measurements at LHC, and prospects for the LHC high Energy run

Monday, 15 December 2014 10:45 (40 minutes)

After the discovery at the LHC in 2012 of a scalar boson with a mass of 125 GeV, which has been found to be an ideal Higgs boson candidate, it is fundamental to understand not only the properties of such particle, but the structure of the whole Higgs sector itself. Several SM extensions (BSM models) predict the existence of additional Higgs bosons which should also couple to the SM particles, hence several searches for additional scalar, pseudoscalar, neutral and charged Higgses are ongoing at the LHC. In this talk are presented the recent results from the ATLAS and CMS experiments in the search for BSM Higgses using the data collected at 7 TeV and 8 TeV and the prospects for the upcoming data-taking runs, starting in 2015.

Primary author: BAUCE, Matteo (Universita e INFN, Roma I (IT))

Presenter: BAUCE, Matteo (Universita e INFN, Roma I (IT))

Session Classification: The State of the Higgs

Contribution ID: 28

Type: **not specified**

Overview of SM Higgs measurements at CMS and constraints on DM from Higgs searches

Monday, 15 December 2014 09:55 (20 minutes)

An overview of Higgs boson results from CMS is presented using pp collision data collected at centre-of-mass energies of 7 and 8 TeV corresponding to integrated luminosities of 5/fb and 20/fb respectively.

The combination of the coupling results of all Higgs boson decay channels measured at CMS is presented with various fits looking for deviations of the couplings from the Standard Model predictions. Measurement of Higgs boson mass from combination of 4-lepton and $\gamma\gamma$ channel is presented.

Studies of the Higgs boson spin and parity are presented using data samples corresponding to the $\gamma\gamma$, ZZ , and WW decay channels. The data are compared to the expectations for a Standard Model Higgs boson, and for several alternative models.

Constraints on the total Higgs boson width, Γ_H , are presented using off-shell production and decay in the ZZ channel. The analyses are carried out in the ZZ to 4-lepton and to 2-lepton-2-neutrino channels, and constraints on the Higgs boson width are obtained.

A search for Higgs boson invisible decay modes has been carried out in events where the Higgs boson is produced in association with a Z boson as well as through Vector Boson Fusion. In the associated production search, electron, muon and b -quark pair decay modes of the Z -boson are considered. No evidence of a signal has been found and upper limits on the invisible branching ratio are obtained and interpreted in a Higgs portal model of dark matter interactions.

Summary

CMS results from Higgs boson analysis. Study of deviations of Higgs couplings from standard model. Study of Higgs boson spin and parity. Measurement of Higgs boson mass and width. Constraints on DM through Higgs portal model from invisible decays of Higgs boson.

Primary author: PLESTINA, Roko (Chinese Academy of Sciences (CN))

Presenter: PLESTINA, Roko (Chinese Academy of Sciences (CN))

Session Classification: The State of the Higgs

Contribution ID: 29

Type: **not specified**

Strategy for the ATLAS pMSSM summary effort

Wednesday, 17 December 2014 09:00 (20 minutes)

The strategy for the ATLAS pMSSM summary effort, which will lead to one of the so-called legacy papers of the collaboration, is presented. A flat scan of the pMSSM parameter space is performed by Tom Rizzo, an ATLAS short term associate. Various constraints are imposed for the scan to select viable models. A broad selection of searches in ATLAS is implemented. The selected models are first evaluated at event generation level in order to select a set we are likely to just about exclude. These will be simulated with AtlFast-II. The goals of the effort are to evaluate the impact of SUSY searches on a large set of pMSSM models, show the reach and complementarity of the searches, identify and classify models that are not excluded. A section is dedicated to the impact of ATLAS on dark matter. As the paper is still in a preliminary stage, no results have been approved for the public.

Primary author: SMESTAD, Lillian (University of Bergen (NO))

Presenter: SMESTAD, Lillian (University of Bergen (NO))

Session Classification: Indirect Dark Matter Searches