Direct Detection

Parallel Session 2 (Rick Gaitskell, Chair) 1 West

Ogburn R. Walter Stanford University, Current results and status of CDMS-II dark matter search
CDMS-II is an experiment for the direct detection of exotic particle dark matter using cryogenic germanium and silicon targets. Since 2003 we have taken data in the deep underground Soudan Mine, with up to thirty detectors (4.75 kg Ge, 1.1 kg Si). The 2003-2004 runs currently lead the field for WIMPs with scalar interactions, and the 2006-2007 data now in analysis will improve this by another factor of four. We present these results and the outlook for continued background-free running into 2008.

Cooley, Jodi Stanford University, CDMS The Key to the Success of SuperCDMS: Lessons from CDMS II Background Studies
Future dark matter experiments need to be able to run in a mode almost free of backgrounds such as cosmogenic neutrons and surface electrons, a.k.a 'betas'. In this talk we present data from the CDMS II experiment that identify the main source of surface betas. In addition, we present the results from simulation studies of cosmogenic neutrons. These studies indicate that the SuperCDMS 25 kg Experiment will operate in a background-free mode.

Mahapatra Rupak University of California, Santa Barbara **,** SuperCDMS: The Next Generation Background Free Dark Matter Search
CDMSII experiment at Soudan has demonstrated incredible event by event background rejection capabilities. Detailed understanding of the gamma, beta and neutron background lead us to a path of at least 20x increase in our background rejection capabilities for the next generation experiment SuperCDMS. 25Kg SuperCDMS experiment will be located in the deep SNOLab, leading to negligible muon induced neutron background. This talk will describe the various improvements planned and in hand, to reach a sensitivity level of 10^-46cm^2 which correspond to covering a sweet spot of SUSY discovery along with LHC.

Gerbier Gilles CEA Saclay **,** Search for Dark matter with Edelweiss : status and future
The Edelweiss program is dedicated to the direct search for Dark Matter with Germanium cryogenic detectors operated in the Laboratoire Souterrain de Modane, in the French Alps at a depth of 4800 mwe. After the initial phase Edelweiss I, which involved a total mass of 1 kg, the second step of this program, the Edelweiss II experiment, currently involving 8 kg of detectors, is now in its commissionning phase. After a brief summary of the results and conclusions from Edelweiss I, the current status and performances of the Edelweiss II set-up, in terms of backgrounds, will be given. Plans towards high sensitivities will be sketched.

Cooper, Peter, Fermilab **,** Status of the CUOPP Dark Matter Search Experiment
COUPP - The Chicagoland Observatory for Underground Particle Physics, is an experiment in the underground MINOS near detector hall at Fermilab to demonstrate the performance of a heavy liquid, room temperature, bubble chamber as a Dark Matter detector. I will report on the operational principles of a mildly super-heated bubble chamber as a nuclear recoil detector immune to betas, gamma and minimum ionizing particles.
Characterization of backgrounds from the 2006 run of a 2.2 Kg engineering prototype detector with CF3I as a working fluid will be shown. Plans for a 66 Kg CF3I detector, now in engineering, will also be discussed.

Wichoski Ubi Laurentian University **,** Status of the PICASSO Dark Matter Search Experiment
The PICASSO experiment searches for cold dark matter through the direct detection of weakly interacting massive particles (WIMPs) via their spin-dependent interactions with nuclei. It uses a superheated fluorocarbon, C4F10, as the active material. The first phase of the experiment (~20g of active mass) ended in 2005. The PICASSO collaboration has started the deployment of the detectors of the second phase in the fall of 2006. For this phase 32 4.5-liter detector modules will be installed in the setup at SNOLAB. The total active mass of the experiment will be ~2.6 kg. In this talk we are going to give a status report on this phase of the experiment and discuss briefly the plans for the next phase.

Gold Michael University of New Mexico **,** "Status and prospects for DRIFT", the Drift II collaboration
The DRIFT II experiment, now running at Boulby in the UK, is a prototype for the only experiment capable of measuring the direction as well as the energy of dark matter particles. The detector is a negative-ion TPC using carbon-disulfide gas at 40 Torr. We report on calibration, background and directional measurements done in the past year, as well as ongoing R&D efforts and future prospects

Theory

Parallel Session 2 (Tom Weiler) Curia 2

Gondolo Paolo University of Utah **,** non-thermal dark matter in non-standard cosmologies
The expansion of the Universe before primordial nucleosynthesis may differ from the standard assumption of a radiation dominated universe. Dark matter particles may be produced in the decay of other fields in addition to the usual thermal

production. I will show that suitable combinations of production mechanisms and a non-standard expansion can produce the required amount of neutralino dark matter. I will also discuss if and how the prospects for their detection improve.

Takayama Fumihiro Cornell University **,** Extremely Long-Lived Massive Particles as A Probe of Reheating of the Universe
We discuss the potential impact of the discovery of long lived charged massive particles with longer lifetime than 10^4sec at future collider experiment, which may indicate a low reheating temperature in the early Universe.

Green Anne University of Nottingham **,** Determining the WIMP mass from direct detection experiments
We study the accuracy with which the WIMP mass could be determined by a superCDMS-like direct detection experiment, given optimistic assumptions about the detector set-up and WIMP properties. We consider WIMPs with an interaction cross-section of sigma_p = 10^{-7} pb (just below current exclusion limits) and assume, initially, that the local WIMP velocity distribution and density are known and that the experiment has zero background. For light WIMPs (mass significantly less than that of the target nuclei) small variations in the WIMP mass lead to significant changes in the energy spectrum. Conversely for heavy WIMPs the energy spectrum depends only weakly on the WIMP mass.
Consequently it will be far easier to measure the WIMP mass if it is light than if it is heavy. With exposures of E= 3 x 10^{3}, 3 x 10^{4} and 3 x 10^{5} kg day (corresponding, roughly, to the three proposed phases of SuperCDMS) it will be possible, given the optimistic assumptions mentioned above, to measure the mass of a light WIMP with an accuracy of roughly 25%, 15% and 2.5% respectively. These numbers increase with increasing WIMP mass, and for heavy WIMPs, m_{\chi} > O(500 GeV), even with a large exposure it will only be possible to place a lower limit on the mass. Finally we discuss the validity of the various assumptions made, in particular regarding the smoothness of the small scale WIMP distribution, and the consequences if these assumptions are not valid.

Schrempp Lily DESY, Hamburg **,** Neutrino Dark Energy -- Revisiting the stability question
The Mass Varying Neutrino Scenario provides a miscroscopic realization of dark energy by introducing a new non-standard model force between neutrinos, which causes a variation of neutrino masses. We have reconsidered the issue of stability arising from the possible strong growth of density perturbations and present examples of viable stable models.

Anchordoqui Luis University of Wisconsin, Milwaukee **,** Quintessence Cold Dark Matter Cosmology from String Theory
I will discuss the cosmological content of Salam-Sezgin six dimensional supergravity, and present a solution to the field equations which is in qualitative agreement with observation of distant supernovae, primordial nucleosynthesis abundances, and recent measurements of the cosmic microwave background. The carrier of the acceleration in the present de Sitter epoch is a quintessence field slowly rolling down its potential. Deep-seated in this framework there is a source of cold dark matter with a mass proportional to an exponential function of the quintessence field.

Banados Max Universidad Catolica de Chile **,** Ground state of general relativity and dark matter
We study general relativity in the limit where the metric vanishes. Under some circumstances we argue that the Einstein tensor has a non-zero value at zero metric, and acts as a `background' curvature. We apply this idea to a spherical source and a cosmological model and prove that in both cases the gravitational potential develops extra contributions similar to those induced by dark matter. These results suggest a topological origin for dark matter.

Astronomy

Parallel Session 2 (Doug Finkbeiner) WH6W (The Dark Side)

Kaplinghat Manoj University of California, Irvine **,** Missing satellites problem and dark matter models
I will discuss recent results pertaining to the Milky Way missing satellites problem and, in this context, briefly talk about Dark Matter small-scale structure predictions in some well-motivated Particle Physics models.

Koushiappas Savvas Los Alamos National Laboratory **,** Dark matter substructure and potential detection with gamma-ray instruments
I will discuss the prospects of detecting cold dark matter via the detection of Milky Way substructure. For dark matter candidates that couple to photons, sub-halos that survive in the present day Milky Way halo can potentially be detected via the annihilation of dark matter particles to a photon final state. I will overview the prospects for detection of dwarf spheroidal systems of the local group, dark substructure in the Milky Way, as well as hypothetical microhalos that formed at very high redshifts.

Zurek Kathryn University of Wisconsin, Madison **,** Small scale power from white noise density perturbations and 21 cm tomography
In concordance cosmology, dark matter density perturbations generated by inflation lead to nonlinear, virialized minihalos, into which baryons collapse at redshift $z \sim 20$. We survey here novel baryon evolution produced by a modification of the power spectrum from white noise density perturbations at scales below $k \sim 10 h {Mpc}^{-1}$ (the smallest scales currently measured with the Lyman-α forest). Exotic dark matter dynamics, such as would arise from scalar dark matter with a late phase transition (similar to an axion, but with lower mass), create such an amplification of small scale power. The dark matter produced in such a phase transition collapses into minihalos, with a size given by the dark matter mass within the horizon at the phase transition. If the mass of the initial minihalos is larger than $\sim 10^{-3} M_\odot$,

the modified power spectrum is found to cause widespread baryon collapse earlier than standard ΛCDM, leading to earlier gas hea ting. It also results in higher spin temperature of the baryons in the 21 cm line relative to ΛCDM at redshifts $z > 20$ if the mass of the minihalo is larger than $1 M_\odot$.

Mohayaee Roya CNRS Researcher **,** Dark matter distribution in haloes: substructures and caustics
I discuss the formation of dark matter haloes and their caustics using self-similar model. The results are compared with numerical simulations. then discuss how dark matter caustics can be detected in the indirect detection and through weak-lensing.

Siegal-Gaskins Jennifer KICP, University of Chicago **,** Do coherent tidal streams imply a lack of dark matter substructure?
In recent years a number of tidal streams have been observed in the Milky Way, and it has been suggested that the existence of coherent tidal streams is incompatible with the abundance of dark matter substructure predicted by lambda-CDM models. We investigate whether current and upcoming observations may constrain Galactic halo models by examining the conditions under which coherent tidal streams can arise. Using the phase-space properties of allowed orbits in Galactic models with various halo shapes, we select a range of orbits which may be more or less susceptible to tidal disruption based on their proximity to phase-space resonances. We simulate the disruption of a self-gravitating satellite on these orbits both with and without substructure, and find that the phase space properties of an orbital path are a much stronger predictor of the degree of disruption the satellite experiences than the absence or presence of substructure. We demonstrate that there is a significant difference in the phase space density of the debris produced on resonant and chaotic orbits, but that the presence of substructure does not lead to a clear systematic change in the phase space density of the debris. We conclude that the observed abundance of tidal streams may indicate the shape of the dark matter halo since the number and strength of phase space resonances is determined by the halo shape, and that the existence of tidal streams is consistent with predicted levels of substructure.

Colliders

Parallel Session 2 (Stephen Martin) 1 North

Iwasaki Yoshihito IPNS, KEK **,** Search for light dark matter in Upsilon(3S) decays at Belle.

McElrath Bob University of California, Davis **,** Estimating Mass in Events with Missing Energy
We present a new statistical estimator for measuring the mass of intermediate resonances and dark matter in cascade decays such as occur in SUSY, UED, and LHT.

Maxim Titov, CEA Saclay, DAPNIA, France "Search for SUSY Trileptons at D0"
In this talk searches are presented for the associated production of the lightest chargino and the next-to-lighest in final states containing 3 charged leptons and missing transverse energy from proton-antiproton collision data at a center-of-mass-energy of 1.96~teV, collected with RunII D0 Detector in 2002-2006, and corresponsing to integrated luminosities of up to 1.1 fb-1.
No excess of candidates was observed with respect to the SM predictions and limits on the chargino mass and production cross-sections are set at 95% CL.
Finally, allowed region in the m0-m1/2 plane based on the cosmological and experimental constraints will be shown and the current sensitivity of the D0 trilepton searches within these constraints will be shortly discussed.

Linnemann James Michigan State University **,** jets and missing Et searches at D0
We will present results from D0 searches for SUSY Squark and Gluino production at the Tevatron in the jets + missing transverse energy channel on an exposure of approximately 1 event/femtobarn. Topologies consisting of acoplanar jet and multijet events with large missing Et were considered. Lower limits of 375 and 289 GeV were derived at 95% CL on the squark and gluino masses, respectively, within the framework of minimal supergravity with tan beta = 3, Ao = 0, and mu < 0, inproving our previous limits by ~ 50 GeV.

Tumanov Alex Rice University **,** CMS – Cosmology at the Microscopic Scale
The world of high energy physics eagerly awaits the startup of the Large Hadron Collider (LHC) that will push the observable energy scale by an order of magnitude. Bounties of new physics data are expected to be accumulated within a relatively short period of time at the Compact Muon Solenoid (CMS) detector – one of two general purpose LHC detectors. Various phenomenological models have been proposed in anticipation this wealth of information. Many of these models are interesting from the Cosmological point of view. In this talk, we give a brief overview some of these models that predict Extra Dimensions, Black Holes and Dark Matter. We give estimates of the discovery potential for these phenomena at the CMS detector. Also, the current status and readiness of the LHC machine and the CMS detector are also presented.