

## Indirect Detection

### ***Parallel Session 1 (Bob Wagner) 1 North***

**Hughes** Richard, Ohio State , GLAST, Dark Matter Search with GLAST"

Indirect detection of particle dark matter relies upon pair annihilation of Weakly Interaction Massive Particles (WIMPs), which is complementary to the well known techniques of direct detection (WIMP-nucleus scattering) and collider production (WIMP pair production). Pair annihilation of WIMPs results in the production of gamma-rays, neutrinos, and anti-matter. Of the various experiments sensitive to indirect detection of dark matter, the Gamma-ray Large Area Space Telescope (GLAST) may play the most crucial role in the next few years. After launch in late 2007, The GLAST Large Area Telescope (LAT) will survey the gamma-ray sky in the energy range of 20MeV-300GeV. By eliminating charged particle background above 100 MeV, GLAST may be sensitive to as yet to be observed Milky Way dark matter subhalos, as well as WIMP pair annihilation spectral lines from the Milky Way halo.

**Vassiliev**, Vladimir, UCLA , Veritas Indirect search for Dark Matter; from Whipple to VERITAS and beyond.

In this talk I review the past efforts of the VERITAS collaboration to detect annihilation radiation from several astrophysical objects with the Whipple 10m telescope, outline the observing program and our expectations for the newly constructed VERITAS observatory, and summarize the capabilities of next generation instruments, AGIS / CTA, for indirect DM searches.

**Jacholkowska** Agnieszka CNRS/IN2P3 , Present and future dark matter searches in HESS

The HESS Air-shower Cherenkov Telescope detects the high energy gamma-rays from various types of astrophysical sources in the southern hemisphere. Among different physics topics, the dark matter signal detection from the galactic sources is one of the outstanding subjects. The data from the Galactic Centre, a region rich in astrophysical standard sources, allowed performing first studies on the dark matter contribution to the observed signal with energy threshold above 120 GeV. Other potentially interesting targets such as Dwarf Spheroidal Galaxies are being currently observed. The results obtained by HESS in view of dark matter detection and their interpretation in the frame of SUSY and extra-dimension models will be presented, and the future HESS phase 2 potential with a low energy threshold will be discussed. The complementarity of the dark matter signal detection by HESS to the New Particle searches at accelerators will also be addressed

**Bartko**, Hendrik Max-Planck-Institut für Physik, Indirect Dark Matter Searches with the MAGIC Telescope

MAGIC is a 17m diameter Imaging Air Cherenkov Telescope installed on the Canary Island La Palma. The telescope is designed for gamma-ray astronomy in the 30 GeV to 30 TeV energy range. Particle physics models predict candidate particles for dark matter, that might annihilate into gamma rays.

Their predicted energy is in the accessible range of the MAGIC telescope.

The expected gamma fluxes depend strongly on the density profiles in the innermost regions of the dark matter halos and on their angular extension.

The prospects and strategies for indirect Dark Matter searches with the MAGIC Telescope will be described. The observability and flux expectations from possible targets will be discussed.

**Finkbeiner** Douglas Harvard University, Exciting" Dark Matter: WIMP Inelastic Scattering

We propose a WIMP candidate with an internal state that can be excited by collisions, and then decay back to the ground state via emission of  $e+e-$  or neutrinos. Such a model would have wide-ranging observational effects, e.g. providing the  $e+e-$  pairs observed by INTEGRAL/SPI in the Galactic center, powering X-ray emission from galaxy clusters, and affecting black hole accretion in the early Universe.

**Strigari**, Louie UC Irvine, Dark Matter Detection from Luminous Milky Way Satellites.

The dark matter content of faint, Milky Way satellite galaxies is becoming known to great precision. I will discuss constraints on the mass of the dark matter halos of these galaxies, and the prospects for detecting gamma rays from dark matter annihilations. The presence of dark matter substructures can increase the fluxes by up to two orders of magnitude, making Milky Way satellites prime candidates for GLAST and future gamma ray missions.

## **Direct Detection**

### ***Parallel Session 1 (Blas Cabrera, Chair) 1 West***

**Gaitskell** Richard Brown University , New Results from XENON10

The XENON10 two phase xenon detector began full operations at Gran Sasso in mid 2006. I will report results from over 3 months of WIMP dark matter search running, with a recoil energy threshold  $<10$  keVr, and a background rate  $<1$  evt/kg/keVee/day. In-situ gamma and neutron calibrations have been performed to define detector EM background rejection and nuclear recoil candidates acceptance.

**Abe** Ko Insitute for Cosmic Ray Research, Status of XMASS

Physics target of XMASS 800 kg detector is direct dark matter search using liquid xenon. Study of basic elements to make

the background extremely low level had been carried out with 100 kg detector. Such as self shielding of Xe, method of position reconstruction and study of background are already well checked and established. Now we are designing the 800 kg detector using geant4 simulation with these informations from the 100 kg detector. I will report the design of 800 kg detector and its estimated performance.

**Smith** Nigel STFC Rutherford Appleton Laboratory , Results from the ZEPLIN-II liquid xenon dark matter detector  
Latest results from the ZEPLIN-II dark matter detector will be presented. This detector is a 30kg liquid xenon target, operated at the UK Boulby facility. results from the first science run will be discussed, including efficiencies and neutron/gamma calibration data.

**Nikkel** James Yale University , The CLEAN and DEAP research programs  
I will be presenting an overview of the current program of the CLEAN and DEAP collaborations to construct a single phase WIMP dark matter detector based liquid neon and argon. I will discuss the design of current and future detectors and how the approaches that we take address backgrounds.

**Svoboda** Robert Lawrence Livermore National Laboratory /UCD, The Large Underground Xenon experiment (LUX)  
Dual-Phase liquid xenon detectors used to detect WIMP-induced nuclear recoils have now reached the 10-kg scale. This technology seems readily expandable to the ton scale and perhaps beyond. The LUX collaboration seeks to realize this sensitivity within the next decade, starting with a 100-kg scale detector. We present the reasons why we think this scale is a useful first step, and why we think such a detector could be built on a very rapid time scale.

## Theory

### *Parallel Session 1 (Bob McElrath) Curia 2*

**Martin** Stephen Northern Illinois University , Natural neutralino dark matter from top squark-mediated annihilation to top quarks  
Supersymmetric models with non-universal gaugino masses can ameliorate the fine-tuning problem of electroweak symmetry breaking. I argue that in this scenario the annihilation of bino-like neutralino pairs to top-antitop quark pairs through top squark exchange can naturally play the crucial role in ensuring that the thermal relic dark matter density is not too large, with only a small role played by coannihilations. The lightest superpartner mass must then exceed the top quark mass, and the lighter top squark cannot decay to a top quark. These conditions have important implications for collider searches.

**Shaughnessy** Gabe University of Wisconsin , Recoil Detection of the Lightest Neutralino in MSSM Extensions  
We investigate the correlated predictions of singlet extended MSSM models for recoil direct detection and the cosmological relic density of the lightest neutralino. We find that the WMAP upper bound on the cold dark matter density limits most of the parameter space to regions where the lightest neutralino can be discovered. The NMSSM and U(1)' extended MSSM typically yield rates similar to the MSSM. The neutralino of the n/mSUSY is often very light and its detection is within the reach of the CDMS experiment in 2007.

**Park** Eun-Kyung Florida State University , Direct and Indirect detection rates for Dark Matter searches in models with a well-tempered neutralino  
In models with a "well-tempered neutralino", where the soft SUSY breaking terms are adjusted to give the measured abundance of CDM in the universe from WMAP, the neutralino is typically of the mixed bino-wino or mixed bino-higgsino state. Along with the necessary enhancement to neutralino annihilation rates, these models tend to give elevated direct detection scattering rates compared to predictions from SUSY models with universal soft breaking terms. We present here direct and indirect detection rates for neutralino dark matter from a variety of models containing a well-tempered neutralino.

**Santoso** Yudi University of Victoria , Gravitino Dark Matter with a Coloured Next to Lightest Supersymmetric Particle  
Gravitino is a candidate for Dark Matter in supergravity models that has become the topics of many recent papers. Due to the very weak interaction it possesses, most signatures of this scenario depend on the Next Lightest Supersymmetric particle (NLSP) which would be metastable. In this talk I would like to discuss scenarios where the NLSP is coloured, in particular the stop in some minimal supersymmetric models.