T 87: Gammaastronomie I

Zeit: Montag 16:45–19:05 Raum: 30.41: 104

Gruppenbericht T 87.1 Mo 16:45 30.41: 104

Suche nach Dunkler Materie mit dem EDELWEISS-2 Experiment — •Klaus Eitel für die EDELWEISS-Kollaboration — Karlsruher Institut für Technologie, Institut für Kernphysik

EDELWEISS ist ein aus kryogenen Germanium-Halbleiterdetektoren aufgebautes Experiment zum direkten Nachweis schwach wechselwirkender massiver Teilchen (WIMPs), das sich im LSM-Untergrundlabor befindet. In der zweiten Ausbaustufe werden zur WIMP-Suche Ge-Kristalle mit Ge-NTD Thermistoren zur Auslese des Phononensignals kombiniert mit ringartigen Aluminium-Elektroden zur Auslese des Ionisationssignals verwendet (ID400-Detektoren von jeweils 400 g Masse). Mit dieser weiterentwickelten Auslesetechnik konnte mit in 2009/2010 aufgenommenen Daten eine Sensitivität von $\sigma_{SI} = 5 \cdot 10^{-44}\,\mathrm{cm}^2$ für elastische Streuung von WIMPs einer Masse von $m_W = 80\,\mathrm{GeV}$ erzielt werden [arXiv:1011.2319]. Mit diesen Resultaten zählt EDELWEISS zu den weltweit sensitivsten Experimenten zur direkten Suche nach Dunkler Materie.

Im Sommer 2010 wurden zusätzlich erstmals Detektoren von 800 g Masse mit einer vollständig mit Ringelektroden bestückten Oberfläche in EDELWEISS installiert. Der Status der Datennahme mit den ID400-Detektoren sowie erste Resultate der Messungen mit den FID800-Detektoren werden diskutiert und die weitere Mess-Strategie von EDELWEISS mit stufenweiser Erweiterung der Targetmasse vorgestellt.

Diese Arbeit wurde in Teilen von der DFG über den SFB-Transregio 27 ("Neutrinos and Beyond") gefördert.

T 87.2 Mo 17:05 30.41: 104

Messung des μ-induzierten Untergrundes in EDELWEISS-II — •Holger Nieder und Benjamin Schmidt für die EDELWEISS-Kollaboration — Karlsruher Institut für Technologie, Institut für Kernphysik, Postfach 3640, 76021 Karlsruhe

Das EDELWEISS-II Experiment zur direkten Suche nach Dunkler Materie (DM) ist im Untergrundlabor von Modane aufgebaut und nimmt seit 2006 Daten. Der Nachweis von WIMPs (Weakly Interacting Massive Particles) soll durch den Nachweis elastischer WIMP-Kernrückstöße in Germaniumbolometern erfolgen. Zur Unterdrückung von myoninduziertem Untergrund ist ein $100\,\mathrm{m}^2$ großes aktives Myonveto-System installiert, welches das Experiment fast vollständig umschließt. Die modulare Struktur des Myonvetos ermöglicht die Rekonstruktion von Myonspuren und damit detaillierte Rückschlüsse auf Winkel- und Abstandsverteilung der Myonen in der Umgebung des EDELWEISS-II Kryostaten. Gemessene Raten und rekonstruierte Topologie myoninduzierter Ereignisse im Myonveto und in den Germaniumbolometern werden vorgestellt.

T 87.3 Mo 17:20 30.41: 104

Measurement of neutron fluxes in the underground laboratory LSM — •Valentin Kozlov for the EDELWEISS-Collaboration — Karlsruher Institut für Technologie, Institut für Kernphysik, Postfach 3640, 76021 Karlsruhe

Edelweiss-2 is a direct Dark Matter search experiment installed in the underground laboratory, Laboratoire Souterrain de Modane (LSM, France), and looking for weakly interacting massive particles (WIMP). The expected interaction rate of WIMPs is below 0.01 events/(kg day), thus rising the importance of having a detailed understanding of potential background. As the current analysis for Dark Matter search shows, ambient and muon-induced neutrons constitute a prominent background component. Detailed studies carried out by the Edelweiss collaboration in this respect are presented. These activities include dedicated calibrations with neutron sources, monitoring the neutron flux with ^{3}He detectors and measurements with a neutron counter based on Gd-loaded liquid scintillator as well as corresponding MC simulations with full event topology. Studies of muon-induced neutrons are of particular interest. The impact of the neutron background on current Edelweiss-2 data-taking as well as for next generation experiments such as EURECA will be discussed.

This work is in part supported by the German Research Foundation (DFG) through the Transregional Collaborative Research Center SFB-TR27 as well as by the EU contract RII3-CT-2004-506222 and the Russian Foundation for Basic Research (grant No. 07-02-00355-a).

T 87.4 Mo 17:35 30.41: 104

Direct Dark Matter Search with EURECA — •Jean-Côme Lanfranchi, Achim Gütlein, Sebastian Pfister, Sabine Roth, Raimund Strauss, Moritz von Sivers, Michael Willers, Andreas Zöller, Stefan Wawoczny, Franz von Feilitzsch, Walter Potzel, and Stefan Schönert — Physik-Department E15, TU München, James-Franck-Strasse, 85748 Garching

The CRESST (Cryogenic Rare Event Search with Superconducting Thermometers) and EDELWEISS (Experience pour Detecter les WIMPs an Site Souterrain) experiments are the basis for the planned EURECA (European Underground Rare Event Calorimeter Array) ton-scale experiment aimed at the direct detection of Dark Matter. A well motivated candidate to account for Dark Matter are WIMPs (Weakly Interacting Massive Particles). The expected WIMP signature consists in a nuclear recoil of a few keV measured in low-temperature detectors using target materials such as Ge, CaWO4 and ZnWO4. The presentation will discuss the unique potentials of the EURECA experiment, as well as technological challenges that have to be met to realize this future multi-material WIMP detector.

T 87.5 Mo 17:50 30.41: 104

Constraints on Dark Matter Annihilation from M87 — •Alexander Summa, Sheetal Saxena, Michael Rüger, Dominik Elsässer, and Karl Mannheim — Institut für Theoretische Physik und Astrophysik, Universität Würzburg

Clusters of galaxies and their central cD galaxies are prime targets for observing indirect signatures of dark matter annihilation owing to their huge mass concentration. The main challenge is to discriminate between high-energy emission of different origins, for example the emission from active galactic nuclei as a result of accretion of mass by the supermassive black hole at the centre of the host galaxy and the emission due to dark matter annihilation. In addition to prompt gamma rays, dark matter annihilation products can include energetic electrons and positrons which inverse Compton scatter with the cosmic microwave background or with starlight photon fields to produce potentially detectable signals going from the soft to the hard X-ray energy band. In order to constrain the dark matter annihilation emission component, a state-of-the-art radiation code for the M87 jet emission and a generic description of the prompt and secondary inverse-Compton gamma rays due to generic weakly interacting dark matter particles are employed and possibilities for identifying the signatures of dark matter in the multi-wavelength spectrum of M87 are investigated.

T 87.6 Mo 18:05 30.41: 104

Solar and atmospheric neutrinos as background for direct dark matter searches — •Achim Gütlein[1], Christian Ciemniak[1], Franz von Feilitzsch[1], Nils Haag[1], Martin Hofmann[1], Christian Isaila[1], Tobias Lachenmaier[2], Jean-Côme Lanfranchi[1], Lothar Oberauer[1], Sebastian Pfister[1], Walter Potzel[1], Sabine Roth[1], Moritz von Sivers[1], Raimund Strauss[1], and Andreas Zöller[1] — [1]Technische Universität München, Physik Department E15 — [2]Eberhard Karls Universität Tübingen

Most experiments for direct dark matter searches are looking for nuclear recoils induced by WIMPs (Weakly Interacting Massive Particles). The most present experiments are able to discriminate between electron recoils (gammas, betas) and nuclear recoils (WIMPs, neutrons, neutrinos). Thus, it is possible to reject most of the background events (i.e. gammas, betas). However, it is not possible to distinguish between WIMP events and neutrinos scattered coherently off the target nuclei. Thus, solar and atmospheric neutrinos can be a serious background for future experiments for direct dark matter searches. We show our calculated limits for future ton-scale experiments due to solar and atmospheric neutrinos.

This work has been supported by funds of the Deutsche Forschungsgemeinschaft DFG (Transregio 27: Neutrinos and Beyond), the Excellence Cluster (Origin and Structure of the Universe) and the Maier-Leibnitz-Laboratorium (Garching).

T 87.7 Mo 18:20 30.41: 104

The Perseus Region in the Light of MAGIC — •Dorothee Hildebrand for the MAGIC-Collaboration — ETH Zurich, Institute for Particle Physics, 8093 Zurich, Switzerland

The Center of the Perseus cluster is an interesting target for Very High Energy (VHE) Gamma-ray Observations. There are three different physics processes that could contribute to a VHE signal: emission from the central giant radio galaxy NGC-1275, emission from hadronic interaction of cosmic rays with the inter-cluster medium, and emission from hypothetical dark matter annihilation.

This talk reports about recent observations of this region by MAGIC, including the detection of Very High Energy emission from NGC-1275 and the head-tail galaxy IC-310.

T 87.8 Mo 18:35 30.41: 104

Searching for Dark Matter in the Perseus Galaxy Cluster — •Jan Storz, Dominik Elsaesser, and Karl Mannheim for the MAGIC-Collaboration — Universität Würzburg, Würzburg, Deutschland

Clusters of galaxies are among the prime candidate targets for indirect dark matter searches. If dark matter annihilations result in emission of very high energy gamma-rays, the expected signal would be superimposed on e.g. the emission from AGNs near the center of the cluster. Based in recent MAGIC observations of the Perseus Cluster, we discuss methods to separate the different observed and expected astrophysical emission components from a potential dark matter induced signal. Special attention is given to extracting limits on various factors which could potentially boost the emission and result in a spatially extended signal.

T 87.9 Mo 18:50 30.41: 104

Search for a DM annihilation signal from the Galactic Centre region with H.E.S.S — •Daniil Nekrassov, Christopher van Eldik, and Werner Hofmann for the H.E.S.S.-Collaboration — Max-Planck Institut für Kernphysik, Postfach 103980, 69029 Heidelberg

A search for a very-high-energy (VHE; $\geq$ 100 GeV) γ-ray signal from self-annihilating particle Dark Matter (DM) is performed towards a region of projected distance $r \sim 45-150$ pc from the Galactic Centre. At this distance, parametrisations of the galactic DM density profile like Navarro-Frenk-White (NFW) or Einasto density agree with each other within a factor of two, contrary to the very centre of the Galaxy, where the deviation can reach orders of magnitude. Thus, as opposed to γ-ray observations of dwarf galaxies or the very centre of the Milky Way, the results derived here do not depend strongly on the assumed DM profile. The background-subtracted γ-ray spectrum measured with the H.E.S.S. γ-ray instrument in the energy range between 300 GeV and 30 TeV shows no hint of a residual γ-ray flux, leading to upper limits on the velocity-averaged annihilation cross section $\langle\sigma v\rangle$ as a function of the DM particle mass, which are among the best reported so far for this energy range, especially if an Einasto-type DM profile is realized by nature.