Magellan Workshop - Connecting Neutrino Physics and Astronomy

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DESY Hamburg

Book of Abstracts

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The SNO+ experiment: current status and future prospects

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SNO+ is a large liquid scintillator based experiment that re-uses the Sudbury Neutrino Observatory detector. The detector, located 2 km underground in a mine near Sudbury, Canada, consists of a 12 m diameter acrylic vessel which will be filled with 780 tonnes of liquid scintillator.
The main physics goal of SNO+ is to search for the neutrinoless double-beta (0n2b) decay of 130Te. During the double-beta phase, the liquid scintillator will be initially loaded with 0.3-0.5% natural tellurium. A sensitivity on the effective Majorana neutrino mass of 55-130 meV is expected in a 5-year run. Designed as a general purpose neutrino experiment, SNO+ can additionally measure the reactor neutrino oscillations, geo-neutrinos in a geologically-interesting location and watch supernova neutrinos. Furthermore, the low energy threshold of SNO+ allows to measure low energy solar neutrinos, like pep and CNO. The pep neutrinos are monoenergetic with a very well predicted flux. A precise measurement of this flux can probe the Mikheyev, Smirnov and Wolfenstein (MSW) effect of neutrino mixing as well as alternate models like Non Standard Interactions. The measurement of the CNO neutrino flux could be used to solve the problem related to the solar metallicity, i.e. the homogeneous distribution of elements heavier than helium in the Sun.
A first commissioning phase with the detector filled with water will begin soon, while the scintillator phase is expected to start after few months of water data taking. The 0n2b decay phase is foreseen for the 2017.
After a brief description of the detector status and the various physics topics covered by SNO+, this talk will focus on the solar and supernova neutrino measurements.
This work is supported by the German Research Foundation (DFG).

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The Supernova Gamma-Ray Burst Connection and High-Energy Neutrinos

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Gamma-ray bursts have often been considered as the natural evolution of core-collapse supernovae. I will discuss the possibility that successful and choked gamma-ray bursts belong to the same class of astrophysical transients and show how the flux of high-energy neutrinos emitted from these sources could provide indirect constraints on the rate of choked bursts.

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Neutrino Geoscience

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Neutrino geoscience is a newly born interdisciplinary field having as its main aim determination of the Earth's radiogenic heat through measurement of antineutrinos released in decays of long-lived radioactive elements inside the Earth, so called geoneutrinos. In fact, such measurements are a unique direct way how to pin-down this key element for many geophysical and geochemical Earth's models. The large volume liquid scintillator detectors, originally built to measure neutrinos or anti-neutrinos from other sources, are capable to detect geoneutrinos, as it was demonstrated by KamLAND (Japan) and Borexino (Italy) projects. Several future experiments as SNO+ or JUNO have their measurements among their prime scientific goals. The talk will cover the status-of-art of this new field, summarizing its potential in terms of geosciences, the status of existing experimental results, and future prospects.

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Searching for neutrino oscillation parameters in long baseline experiments

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Developing neutrino astronomy requires a good understanding of the neutrino oscillations mechanism. The European strategy for neutrino oscillation physics sets a high priority on future long baseline neutrino experiments with the aim to measure the intrinsic parameters that govern the neutrino oscillations. In this talk we take a look at the next generation of long baseline experiments and discuss their prospects in future research.

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Gamma-ray blazars as possible PeV neutrino sources

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The detection of the extraterrestrial neutrino signal at PeV energies
by IceCube prompted the question of astrophysical origin. We study the
broadband spectral energy distribution of gamma-ray loud blazars in positional agreement with the PeV neutrinos "Ernie, Bert and Big Bird", using broadband data collected in the framework of the multiwavelength
monitoring program TANAMI. Assuming a simple photo pion production
emission model, we show that the gamma-ray emission of the blazars can explain the observed PeV neutrino events.

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Latest results from LUNA experiment

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Cross sections of nuclear reactions relevant for astrophysics are crucial ingredients to understand the energy generation inside stars and the element nucleosynthesis. At astrophysical energies, nuclear cross sections are often too small to be measured in laboratories on the Earth's surface where the signal would be overwhelmed by the cosmic-ray induced background.
LUNA (Laboratory for Underground Nuclear Astrophysics) is an experimental approach for the study of nuclear fusion reactions based on an underground accelerator laboratory.
Since 20 years the LUNA Collaboration has been directly measuring cross sections of nuclear processes relevant in several astrophysical scenarios in the underground laboratories of Laboratori Nazionali del Gran Sasso (LNGS) with unprecedented sensitivity.
In the talk the latest LUNA results will be presented, focusing mainly on the 22Ne(p,g)23Na cross section measurement. This reaction takes part in the neon-sodium cycle of hydrogen burning and influences the synthesis of the elements between 20Ne and 27Al in red giant stars and novae explosions.
Future researches will be carried out in the frame of the LUNA-MV project which aims at measuring several astrophysical key reactions. The scientific program of LUNA-MV as well as status and schedule will be presented.

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The atmospheric muon charge ratio: a probe to constrain the atmospheric neutrino/anti-neutrino ratio

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The atmospheric muon charge ratio, defined as the number of positive over negative charged muons, is an important observable to shed light on the physics of cosmic ray interactions in atmosphere.
It allows studying the features of high-energy hadronic interactions in the forward region and the composition of primary cosmic rays.
In particular, the muon charge ratio provides sensitivity to the charge ratio of high energy kaons, the principal parents of atmospheric neutrinos.
In this talk the results from the OPERA experiment in the TeV energy range are reviewed.

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Asteroseismology

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Stars are opaque bodies and asteroseismology, a quasi-direct way to peer inside stars through their global oscillations, can be used to study stellar internal structures. These global oscillations have provided essential insights into the internal structures of the Sun (helioseismology) and many other stars. Results based on state of the art (space) telescopes and the potential of asteroseismology for the near future, will be discussed during this talk.

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The ejecta of supernova 1987A

Author: Josefin Larsson[1]

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Due to its proximity SN 1987A offers a unique opportunity to directly observe the geometry of a stellar explosion as it unfolds. In this talk I will present recent spectral and imaging observations of SN 1987A obtained with the HST and VLT. These observations make it possible to determine the three-dimensional distribution of different elements in the ejecta. The geometry is highly asymmetric, reflecting the conditions at the time of the explosion. The observations also reveal the first detection of molecular hydrogen in a supernova, which provides important diagnostic information about the conditions in the ejecta.

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Solar neutrino detection in a large volume double-phase liquid argon experiment

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Two-phase liquid argon time projection chambers (LAr TPCs) are prime candidates for the ambitious program to explore the nature of dark matter. The large target, high scintillation light yield and good spatial resolution in all three cartesian directions concurrently allows also a high precision measurement of solar neutrino fluxes via elastic scattering. We studied the cosmogenic and radiogenic backgrounds affecting solar neutrino detection in a 300 tonne (100 tonne fiducial) LAr TPC operating at LNGS depth (3,800 meters of water equivalent). Such a detector could measure the CNO neutrino rate with 5 sigma sensitivity, and significantly improve the precision of the 7Be and pep neutrino rates compared to the currently available results from the Borexino organic liquid scintillator detector.

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Diffuse neutrinos from extragalactic supernova remnants: Dominating the 100 TeV IceCube flux

Author: Ignacio Izaguirre[1]

[1] *Max-Planck-Institut für Physik (Werner-Heisenberg-Institut)*

In this talk, I will give a brief introduction to cosmic rays and their connection to high energy cosmic neutrinos. In this context I will introduce the IceCube experiment and its measured diffuse astrophysical flux of TeV-PeV neutrinos. The most plausible stellar sources for this diffuse flux are unique high energy cosmic ray accelerators like hypernova remnants (HNRs) and remnants from gamma ray bursts in star-burst galaxies, which can produce primary cosmic rays with the required energies and abundance. In this case, however, ordinary supernova remnants (SNRs), which are far more abundant than HNRs, produce a comparable or larger neutrino flux in the ranges up to 100-150

TeV energies, implying a spectral break in the IceCube signal around these energies. The SNRs contribution in the diffuse flux up to these hundred TeV energies provides a natural baseline and then constrains the expected PeV flux.

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Physics Opportunities with SN neutrinos

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The detection of neutrinos from the next galactic supernova (SN) represents the next frontier of low-energy neutrino astronomy.
I will present the physical potential of a future supernova neutrino observation to probe the SN explosion mechanism and the fundamental neutrino properties.
In particular, I will discuss the surprising collective behavior of SN neutrino flavor conversions, associated with neutrino-neutrino interactions in the deepest SN regions, and their impact on the neutrino burst.

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Introduction the Zwicky Transient Facility

Author: Marek Kowalski[1]

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I will present the Zwicky Transient Facility (ZTF) to start operation in 2017. Located at Mount Palomar, ZTF will enable a 3pi search for transient objects to a depth limit of 21 magnitudes. With on-site instruments available for spectroscopic follow-up, ZTF will identify thousands of Supernovae and other optical transients over the course of the survey. I will discuss selected science questions that can be adreessed by ZTF.

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Radio emission from energetic particle cascades

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The radio-detection of high-energy particles has recently undergone a revival, with current experiments using the Earth's atmosphere, Antarctic ice, and even the lunar regolith as a detection medium for cosmic rays and neutrinos. In this talk, I will briefly review the range of experiments using the radio technique to search for and study these particles, and outline the phenomenology of the Askaryan and geomagnetic effects that produces the emission. I will then delve a little deeper into

the theory of radio-emission, and try to provide some insight into how the calculation methods implemented in programs such as CoREAS and ZHAireS have enabled them to successfully model the emission.

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Planck 2015 cosmological results

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The Planck satellite is an ESA mission that has observed the full sky at nine frequencies between 30 GHz and 1 THz from 2009 to 2013. It represents the third generation, after COBE and WMAP, of satellites dedicated to the observation of the Cosmic Microwave Background radiation (CMB).
The CMB anisotropies represent the picture of primordial perturbations that originated the present structures of the Universe and Planck has performed their measurement over the whole sky with unprecedented accuracy in temperature and polarization.

In 2015 the Planck full mission data and cosmological results have been released to the public. It is the first Planck release to include also polarization data and analysis.

I will present the cosmological results delivered by the Planck collaboration, focusing on the constraints on the most important extensions to the standard cosmological model.

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Neutrino astrophysics with JUNO

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The Jiangmen Underground Neutrino Observatory (JUNO) is an international project centered on a 20 kt liquid scintillator neutrino detector currently under construction about 730 m below the surface at a location close to Kaiping, China. Its expected start of data taking is around 2020. The experiment primarily aims for a determination of the neutrino mass ordering with more than three sigma significance and precision measurements of neutrino oscillation parameters
by investigating reactor electron anti-neutrino disappearance over a
~53 km long baseline. Besides that, the project based on a liquid scintillator measurement device of unprecedented size also features a rich physics program around low-energy astrophysical neutrinos, which is the main topic of this talk: In case of a galactic core-collapse supernova at 10 kpc distance, the high-statistics neutrino signal (>7000 events) provides detailed energy-, time- and flavor-resolved information on the cosmic incident. Depending on the performance to reject the critical background from neutral-current interactions of atmospheric neutrinos, there might be even a chance to get a positive signal on the three-sigma level for the diffuse supernova neutrino background after ten years of measurement. Moreover, the large target mass, the low energy threshold, and the very high energy resolution of JUNO make the liquid scintillator detector attractive for solar neutrino observations. With dedicated efforts to realize the required low background conditions, measurements of neutrinos from the Sun with JUNO can probe the transition region between vacuum-dominated and MSW-dominated neutrino oscillations. Moreover, such measurements can also help to resolve the solar metallicity problem.

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Monte Carlo simulations in neutrino physics: the example of the SOX experiment

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The talk describes the SOX project which aims to test the existence of light sterile neutrinos. A solid signal would mean the discovery of the first particles beyond the Standard Electroweak Model and would have profound implications in our understanding of the Universe and of fundamental particle physics. In case of a negative result, it is able to close a long standing debate about the reality of the neutrino anomalies. The SOX experiment will use a Ce-144 antineutrino generator placed at short distance from the Borexino liquid scintillator detector. Particular emphasis will be devoted in describing how a simulation of a neutrino detector is implemented and how it can be used to obtain useful information for the future data analysis.

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The SOX experiment: understanding the detector behavior using calibration sources

Author: Alessio Caminata[1]

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In view of the SOX experiment, a precise knowledge of the energy response and the spatial reconstruction of the antineutrino events is very important. Consequently, a calibration campaign of the Borexino detector is foreseen before the beginning of the SOX data taking. The poster will show which are the experimental techniques to calibrate a liquid scintillator experiment like Borexino

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Detection of a Type IIn Supernova in Optical Follow-Up Observations of IceCube Neutrino Events

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The IceCube neutrino observatory pursues a follow-up program, which selects interesting neutrino events in real-time and issues alerts for electromagnetic follow-up observations. In March 2012, the most significant neutrino alert during the first three years of operation was issued by IceCube. In the follow-up observations performed by the Palomar Transient Factory (PTF), a Type IIn supernova (SN), PTF12csy, was found 0.2 degrees away from the neutrino alert direction, with an error radius

of 0.54 degrees. It has a redshift of $z = 0.0684$, corresponding to a luminosity distance of about 300 Mpc, and the Pan-STARRS1 survey shows that its explosion time was many months before the neutrino alert, so that a causal connection is unlikely. The a posteriori significance of the chance detection of both the neutrinos and the SN at any epoch is 2.2 σ within IceCube's 2011/12 data acquisition season. Also, a complementary neutrino analysis reveals no long-term signal over the course of one year. Therefore, the SN detection is considered coincidental and the neutrinos uncorrelated to the SN. However, the SN is unusual and interesting by itself: It is luminous and energetic, bearing strong resemblance to the SN IIn 2010jl, and shows signs of interaction of the SN ejecta with a dense circumstellar medium. High-energy neutrino emission is expected in models of diffusive shock acceleration, but at a low, non-detectable level. In this talk, the optical follow-up system is introduced, the neutrino and electromagnetic data gathered from the SN PTF12csy are presented, and the data analysis and possible interpretations are discussed.

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Recent results from the MAGIC telescopes

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MAGIC (Major Atmospheric Gamma Imaging Cherenkov) is a system of two imaging atmospheric Cherenkov telescopes located at the Canary island of La Palma. Since more than 11 years, the telescopes are performing scientific observations of gamma rays with energies between 35 GeV and tens of TeV.

In this talk I will present the highlights of the observations performed with the MAGIC telescopes concerning both galactic, such as supernova remnants, and extragalactic sources, e.g. active galactic nuclei, also in the context of multi-messenger astronomy.
Among this, the ultra-fast variability of IC 310, challenging jet emission models in AGNs will be discussed. Furthermore, I will present the detection of the very high energy gamma-ray emission from two active galaxies located at redshift of ~0.94: gravitationally lensed blazar B0 218+357 and FSRQ PKS 1441+25. Finally, the newest measurements of the TeV emission from Crab pulsar and its nebula will be shown.

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CNO Neutrinos and Metallicity of Stars

Author: Stefano Davini[1]

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The detection of neutrinos resulting from the CNO cycle would be the first direct evidence of the nuclear process that is believed to fuel massive stars.
A precise measurement of the CNO solar neutrino fluxes would also help resoliving the solar metallicity problem, as the predicted fluxes strongly depend on the inputs of the solar modelling.
In this presentation I will explain the connections between CNO neutrinos and solar metallicity, and review the experimental attempts to detect them.

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Searches for point-like neutrino sources with the ANTARES neutrino telescope

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ANTARES is the largest undersea neutrino telescope currently on operation. This telescope has been in continuous operation since 2007 with the aim to detect neutrinos from astrophysical sources. A review of the point-like neutrino sources with the ANTARES telescope will be shown. One one hand, the latest results of the all-flavour neutrino point-source analysis with data from 2007 to 2013 will be described. The results of the first combined ANTARES and IceCube analysis will also be given.

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Connecting neutrino Astrophysics to Multi-TeV to PeV gamma-ray Astronomy with TAIGA

Author: Martin Tluczykont[1]

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Recent evidence for neutrinos in the PeV energy range from IceCube further motivates the search for the most energetic Galactic accelerators. Gamma-ray astronomy is a sound strategy to reach this goal, providing the energy range beyond 10 TeV can be covered at a sufficient sensitivity level. The energy spectra of most known gamma-ray emitters only reach up to few 10s of TeV. The HEGRA IACT installation reported evidence for gamma-ray energies from the Crab Nebula as high as 80 TeV. Uncovering their spectral shape up to few 100s of TeV could answer the question whether some of these objects are cosmic ray Pevatrons, i.e. Galactic PeV accelerators. Extending observations beyond this energy range requires very large effective detector areas of the order of 10s to 100 square-km. While imaging air Cherenkov telescopes have proven to be the instruments of choice in the GeV to TeV energy range, large detector areas are more easily accessed with the (non-imaging) shower-front timing technique which also naturally provides large viewing angles. The poor gamma-hadron separation power of shower front timing arrays can be compensated by a combination with small imaging air Cherenkov telescopes. Such a new hybrid detector concept is currently being implemented by the TAIGA collaboration in the Tunka-valley in Siberia. The potential of the hybrid technique to access the Pevatron energy range and the status of the TAIGA project will be presented.

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Neutrino Interactions in Core Collapse Supernovae

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Interactions of neutrinos with the hot an dense matter of a proto neutron star play a major role in determining the fate of core collapse supernovae (CCSNe). The influence of neutrinos ranges from (re-)launching the supernova explosion through neutrino heating, to the nucleosynthesis of heavy elements in the neutrino driven wind or neutrino-nucleosynthesis.
This talk will partly review the current implementation of neutrino interactions in CCSNe and point to open questions and known problems. In particular, we will ask for the relevant neutrino interactions and how to numerically implement them. Also we will discuss the role of choosing the right equation of state for nuclear matter. Recent progress with respect to many of these aspects will be presented. Eventually we look at possible changes in the predicted neutrino spectra from CCSNe and how they might affect the production of heavy elements in the neutrino driven wind.

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HESS-II: gamma-ray astronomy from tens of GeV to hundreds of TeV energies

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Since the commissioning of the fifth, large telescope in December 2012, H.E.S.S. II is the only array of Imaging Atmospheric Cherenkov Telescopes operating telescope of different sizes. Recent years have seen a tremendous effort in the design, implementation and optimisation of analysis techniques as well as improvements to the entire data acquisition scheme to allow for a very fast response to external triggers. With its excellent sensitivity, broad energy coverage, and fast reaction time, H.E.S.S. II provides an unprecedented view of the Universe at very high energies, in a multi-wavelength and multi-messenger approach. In this contribution we will present some highlights of the first data taken with H.E.S.S. II and discuss its potential for the study of transient objects. Additionally, we will also show highlights from ten years of H.E.S.S. phase I observations like the legacy data release of the H.E.S.S. Galactic Plane Survey.

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Measurement of solar neutrino fluxes with Borexino

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Solar neutrinos have been pivotal to the discovery of neutrino flavor oscillations and are a unique tool to probe the reactions that keep the Sun shine. The Borexino experiment located in the Gran Sasso National Laboratory, is an organic liquid scintillator detector conceived for the real time spectroscopy of low energy solar neutrinos. Thanks to the unprecedented background levels, Borexino performed the first flux measurements of the several solar neutrino components which power the Sun. We review these breakthrough results and we also discuss the upcoming future of Borexino, which is entering the precision era of solar neutrino measurements.

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Neutrino oscillations with IceCube

Author: Juan Pablo Yanez Garza[1]

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Very large volume neutrino telescopes observe atmospheric neutrinos over a wide energy range (GeV to TeV), after they travel distances as large as the Earth's diameter. DeepCore, the low energy extension of IceCube, has started making meaningful measurements of the atmospheric oscillation parameters. PINGU, a proposed extension to lower DeepCore's detection threshold, aims to use the same neutrino flux to further increase the precision with which these parameters are known, and eventually determine the neutrino mass ordering. The transition from the currently running DeepCore to the proposed PINGU, as well as their latest results, are discussed in this talk.

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Solar models, neutrinos, and composition

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Standard solar models (SSMs) provide a reference framework across a number of research fields: solar and stellar models, solar neutrinos, particle physics the most conspicuous among them. The accuracy of the physical description of the global properties of the Sun that SSMs provide has been challenged in the last decade by a number of developments in stellar spectroscopic techniques. Over the same period of time, solar neutrino experiments, and Borexino in particular, have measured the four solar neutrino fluxes from the pp-chains that are associated with 99% of the nuclear energy generated in the Sun. Borexino has also set the most stringent limit on CNO energy generation, only ~ 40% larger than predicted by SSMs. More recently, and for the first time, radiative opacity experiments have been performed at conditions that closely resemble those at the base of the solar convective envelope. In this article, we review these developments and discuss the current status of SSMs, including its intrinsic limitations.

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Simulation of imaging air shower Cherenkov telescopes as part of the TAIGA Project

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The Tunka Advanced International Gamma-ray and Cosmic ray Astrophysics (TAIGA) project aims at observation of cosmic rays and gamma rays at and beyond 100 TeV via observation of the extensive air showers (EAS) caused in the atmosphere. The low fluxes in this energy regime make huge effective areas necessary for sensitive measurements.

It is possible to instrument very large detector areas with a wide field of view using the non-imaging shower front sampling technique. Such detector arrays provide a good event reconstruction quality. However, comparing to other methods the separation between the nature of the shower's possible primaries is only poor.
In matters of gamma hadron separation and reconstruction, imaging air Cherenkov telescopes (IACT) are the better instrument, but since a stereoscopic view of a shower is needed for high reconstruction accuracy, it is difficult to achieve the large effective areas needed for ultra high energy observations. To optimize the sensitivity, one can combine the two approaches, using both technique's strengths. The TAIGA project will combine the existing HiSCORE timing array with small HEGRA-like imaging telescopes. In this work we present the simulations about the properties of our IACT design and the first steps towards hybrid reconstruction. These simulations are used to explore and optimize this technique and its sensitivity.

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The GERDA Experiment

Author: Michael Miloradovic[1]

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The Germanium Detector Array (GERDA) experiment, located at
the Laboratori Nazionali del Gran Sasso (LNGS), is searching for the
neutrinoless double beta decay of Ge-76. The observation of this Beyond
the Standard Model process would prove the existence of a neutrino
Majorana mass component and provide information on the neutrino
mass hierarchy and absolute mass scale. The Majorana nature of the
neutrinos could be responsible for the matter anti-matter asymmetry
in the early universe.

The GERDA experiment operates enriched germanium diodes, acting simultaneously as the source and detector material, directly submerged in liquid argon. As a result, Phase I of GERDA achieved the world's best lower limit of T_1/2(0νββ)

> 2.1 · 1025 yr (90% C.L.) on the half-life of the neutrinoless double beta decay of 76 Ge.
> With the recent completion of the upgrade to Phase II, an additional 20 kg of germanium detectors – for a total of 35 kg – and a liquid argon veto system have been implemented.
> The goal is an order of magnitude
> lower background with a projected sensitivity of 1.4 · 1026 yr for T_1/2(0νββ).

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SN 1987A

Author: Bruno Leibundgut[1]

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SN 1987A has provided us with the opportunity to learn more about core collapse supernovae than with any other event. The evolution of this object has been followed in great detail with all available observing facilities and delivered an unprecedented record of the explosion. There are many unique observations of this object: the neutrino burst indicating the collapse to a neutron star, the early evolution giving evidence that the progenitor star was a compact blue giant star and that there must have been significant mixing of the elements within the explosion, the circumstellar ring - presumably a remnant of the stellar evolution of the progenitor star, the formation of dust in the

ejecta, and the shock interaction of the supernova ejecta with its surroundings. SN 1987A is the first supernova where we can observe the inner ejecta directly and can also follow the effects of shocks on the ring and the ejecta.

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A Search for Lorentz Violation using the T2K Near Detectors

Author: Alex Clifton[1]

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Lorentz symmetry violation (LV) arises when the behavior of a particle depends on its direction or boost velocity. This fundamental symmetry violation is expected to occur at the Planck scale (~10^19 GeV). The Standard Model Extension (SME) is a general theoretical framework that includes both General Relativity and the Standard Model while also allowing for the spontaneous breaking of Lorentz symmetry through a set of controlling coefficients. As predicted by the SME, neutrinos couple to a background tensor feld that is fixed in space and time. As a neutrino beam experiment on Earth rotates with the Earth's sidereal frequency, a neutrino beam experiment will exhibit a sidereal time dependence in the neutrino oscillation probabilities. At baselines shorter than the neutrino oscillation length, oscillation probabilities are calculated in the SME which are entirely due to LV effects. A search for LV at the T2K near detectors with baselines of 280 m is presented. The protons-on-target normalized neutrino event rate at the T2K near detectors is used to search for LV using a shape-only analysis via Fast Fourier Transform (FFT) analysis and a binned log-likelihood fit. No indication of LV is observed with either method in the T2K near detector data. The FFT analysis was used to study the four Fourier modes relevant in the oscillation probability and the binned log-likelihood fit was used to set upper limits on the amplitudes associated with each sidereal time harmonic.

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Introduction to the Magellan Workshop.

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High Energy Emissions of Active Galactic Nuclei

Author: Ievgen Vovk[1]

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The high-energy emission of Active Galactic Nuclei (AGNs) is believed to be produced in the jets, powered by their central supermassive black holes. At the same time the location of the emission region within the jet is presently uncertain - mainly due to its extremely small angular size, far beyond the capabilities of the existing gamma-ray instruments. However, in the rare case of the gravitationally lensed AGNs, it is possible to use the natural "lens" to assist the situation. I will report on the detection of the gravitational microlensing effect in two gamma-ray loud AGNs, which allowed for the first time to resolve their emission regions, providing strong arguments for their connection with the direct vicinities of the corresponding central black holes.

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Poster Abstract Magellan Workshop 2016 (Ahlgren)

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The origin of the prompt emission in gamma-ray bursts (GRBs) is still an unsolved problem and several different emission mechanisms have been suggested. In this poster we show work from Ahlgren et al. (2015) where we fit Fermi GRB data with a photospheric emission model which includes dissipation of the jet kinetic energy below the photosphere. The resulting spectra are dominated by Comptonization and contain no significant contribution from synchrotron radiation. In order to fit the model to data we span a physically motivated part of the model's parameter space and create DREAM (Dissipation with Radiative Emission as A table Model), a table model for XSPEC. We show that this model can describe different kinds of GRB spectra, including GRB 090618, representing a typical Band function spectrum, and GRB 100724B, illustrating a double peaked spectrum, previously fitted with a Band+blackbody model, suggesting they originate from a similar scenario. We suggest that the main difference between these two types of bursts is the optical depth at the dissipation site.

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Status and commissioning of the KATRIN spectrometer and detector section

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The goal of the KArlsruhe TRItium Neutrino experiment (KATRIN) is to investigate the neutrino mass with a sensitivity of 0.2 eV/c^2 by a high-resolution and high-statistics measurement of the end-point region of the H-3 β-spectrum. For this task it uses an experimental setup made of two main parts, firstly a source and transport section including a windowless gaseous tritium source, a differential and a cryogenic pumping section. This system provides a clean current of H-3 β-electrons that are analyzed and detected in the second part, namely the spectrometer and detector section. The latter section consists of two electrostatic spectrometers based on the MAC-E filter technique and a multi-pixel silicon semiconductor detector.
At the experimental site at the Karlsruhe Institute of Technology (KIT), all major components have arrived in summer 2015 and the complete beam line is currently being assembled. Three commissioning phases have been pursued with the main spectrometer and the detector. The combined commissioning of the entire setup will start in summer 2016 and lead the way to first tritium measurements.
This talk gives an overview of the current status of the KATRIN experiment, focusing on the recent commissioning phases.
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Neutron Shielding Simulations and Muon-induced Neutrons

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Neutrons can create background in experiments built to search for rare events like neutrinoless double beta decay. Cosmic ray induced neutrons can activate materials used in the experiment during transportation or storage. Although neutrons can be shielded during storage and transportation, muons penetrate and can produce neutrons inside the shield.
Cosmic-ray neutrons and muons were simulated with the GEANT4 based framework MaGe to determine the shielding indices for different materials. The effects of backscattering and angular distributions will be discussed.
The MINIDEX experiment which started its operation 2015 and aims to measure muon-induced neutrons in different target materials will be presented.

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On the history of the Hamburg Observatory

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This contribution aims to provide an overview of the history of the Hamburg Observatory from its early days up to the present. It highlights some of the notable individuals as well as a select few projects that played major roles for astronomy and astrophysics in Hamburg.