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Book of Abstracts

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Gamma-ray emission from Crab pulsar and the nebula: paradigm shifts?

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The detection of Crab pulsar by VERITAS collaboration as well as Agile and Fermi results on gamma-ray pulsars imply the dominance of the Inverse Compton scattering over the curvature radiation and signify an important shifts in our understanding of pulsar high energy emission.

Recent observations of flares in the Crab nebula call into question the prevalent model of particle acceleration in relativistic astrophysical environments, the stochastic shock acceleration. Magnetic reconnection is likely to play an important, and perhaps a dominant role.

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Inductive acceleration of UHECRs in sheared relativistic jets

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Relativistic outflows carrying large scale magnetic fields have large
inductive potential and may accelerate protons to ultra high energies.
We discuss a novel scheme of Ultra-High Energy Cosmic
Ray acceleration due to drifts in
magnetized, cylindrically collimated, sheared jets of powerful active galaxies.

We point out that a
positively charged particle carried by such a flow may be in an unstable
equilibrium, so that a kinetic drift along the velocity shear would lead
to fast, regular energy gain. The key features of the mechanism are (i) the
highest rigidity particles are
accelerated most efficiently implying
the dominance of light nuclei for extragalactic CRs; (ii)
acceleration rate increases with energy and does reach the theoretical
maximum of inverse relativistic gyro-frequency.

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TeV Gamma anisotropy connection with UHECR map: solving the link by ultrarelativistic radioactive nuclei decay in flight?

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The TeV gamma anisotropy in ARGO,MILAGRO and ICECUBE is one of the novel surprising discover of the decade. The TeVs or hundred TeV nucleons or nuclei cannot trace far their original sources because of the severe smearing by galactic fields. Gamma sources (AGN) cannot shine much far because IR-TeV photo opacity and their image might be a point source and not wide spread sky area. Galactic UHECR nuclei may keep a trace of their origination, but they may suffer narrow or wide bending either if light or heavy nuclei. However they cannot eject much gamma in flight by photo-dissociation, because of their local (galactic) distances travel . Nevertheless UHECR radioactive nuclei, bent and smeared, may shine their hundred keV decaying photons because of the UHECR Lorentz boost in an observable (and observed?) in TeV gamma sky.
Therefore TeV anisotropy may correlate with UHECR map, as we did note, connecting both maps to nearby galactic sources.

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Overview of the Galactic results obtained by MAGIC

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MAGIC is a system of two atmospheric Cherenkov telescopes which explores the very-high-energy sky, from some tens of GeV up to tens of TeV. Located in the Canary island of La Palma, MAGIC has the lowest energy threshold among the instruments of its kind, well suited to study the still poorly explored energy band below 100 GeV. Although the space-borne gamma-ray telescope Fermi/LAT is sensitive up to 300 GeV, gamma-ray rates drop fast with increasing energy, and statistics are scarce above few GeV. Therefore, the combination of MAGIC and Fermi/LAT observations have provided the first astrophysical spectra sampled in the inverse Compton peak region, resulting in a complete coverage from MeV up to TeV energies, as well as the discovery of a pulsed emission in the very-high-energy band.
This talk focuses on the latest results on Galactic sources obtained by MAGIC which are highlighted by the detection of the pulsed gamma-ray emission from the Crab pulsar up to 400 GeV. In addition, we will present the morphological study on the W51 complex which allowed to pinpoint the location of the majority of the emission around the interaction point between the supernova remnant W51C and the star forming region W51B, but also to find a possible contribution from the associated pulsar wind nebula. Other important scientific achievements involve the Crab Nebula with its unperceived spectrum which covers three decades in energy, starting from 50 GeV, and the HESS J1857+026 source with its morphological study which supports the pulsar wind nebula scenario. Finally we will report on the searches of very-high-energy signals from gamma-ray binaries, mainly LS I +61 303 and HESS J0632+057.

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On-Ground Calibration of AGILE-GRID with a Photon Beam. Results and lessons for the future.

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AGILE, an Italian Space Agency mission launched in April 2007, has at is core a pair-production Gamma Ray Imager (GRID) sensitive from 30 MeV-50GeV. The instrument was calibrated before launch in the Beam Test Facility at the INFN Laboratori Nazionali di Frascati using a tagged photon beam designed for the purpose.
The data were used to measure the effective area, energy dispersion, and point spread function versus the photon direction and energy under beam test condition and to validate the Monte Carlo simulation to be used for estimating the same quantities in flight condition.
This calibration required first a careful characterization of the photon tagging system in terms of efficiency and energy resolution, followed by an analysis of the AGILE data.
During this analysis we identified some problems in the calibration setup that limited the precision of our calibration.
We discuss these limitations and suggest an improved setup for calibration of future gamma ray telescope on satellite.

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Hunting for cosmic neutrinos deep under the sea: The ANTARES experiment

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More than one hundred years after the first observations of cosmic rays, and in spite of the impressive amount of data that have in the meantime been collected, many of the problems connected with their origin and propagation remain unsolved.
It is a common, but poorly supported, belief that they must originate from catastrophic events which take place in our as well as in other Galaxies.
Events such as Supernova explosions, Active Galactic Nuclei, Quasars and Microquasars, which are likely sources of high energy cosmic rays and gamma rays, could be intense neutrino sources as well. The measurement of the arrival direction and energy of such neutrinos, that would clarify the production mechanisms of high energy hadrons and gammas, requires very massive targets, of sizes far beyond those of present, conventional underground detectors. A possible solution, suggested and tested over 20 years ago, is the use of the sea as a Cerenkov target-detector.
One such detector, ANTARES, has been built in the Mediterranean by a large international collaboration and is in operation since 2008.
I plan to describe the experimental technique, the sensitivity of the experiment and the first results that have been obtained in the search for neutrinos from point sources, on the neutrino diffuse flux and on several other items. I will also make a short comparison with other detectors of the same or similar type, now in operation or being designed.

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Observations of Pulsar Wind Nebulae in Gamma-rays from GeV to TeV energies

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Since 2003, the continuous observations of the Galactic Plane by Atmospheric Cherenkov Telescopes, especially by H.E.S.S., have yielded the detection of more than 60 Galactic sources. Among them, Pulsar Wind Nebulae (PWNe) are the dominant class with more than 15 sources firmly identified.

In the GeV energy range, observations have been made possible through the launch of the Fermi-Large Area Telescope operating in the band between 20 MeV and 300 GeV. During its first 3 years of operation, it has detected high energy emission from several TeV PWNe, including the Crab Nebula, MSH 15-52, Vela or HESS J1825-137. In addition, upper limits derived on well-known PWNe have brought new constraints on the physical properties of these objects.

In this presentation, I will review the recent results obtained with the Fermi-LAT and the H.E.S.S. experiments and give a general overview of the gamma-ray population of Pulsar Wind Nebulae.

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CALET: a calorimeter for cosmic-ray measurements in space

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The CALorimetric ELectron Telescope (CALET) is a space-station-borne experiment aimed at precise measurements of the electron+positron, ion and gamma-ray components of the cosmic-ray spectrum, in an energy range starting from tens of GeV up to tens of TeV. The heart of the detector is a deep (~27 X0) homogeneous calorimeter made by lead tungstate (PWO) scintillating bars, which can measure the energy of electrons and gamma-rays with an uncertainty of a few percent and give an electron/proton rejection factor about 10^5. An imaging pre-shower calorimeter composed of tungsten and scintillating fibers is used to track the incoming particle, while charge identification is done by means of a system of scintillating rods. The design and performance of the detector will be presented, together with some preliminary results based on Monte Carlo simulations.

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Latest results of the Pierre Auger Observatory

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The Pierre Auger Observatory, located near Malargue, in the Province of Mendoza, Argentina, was designed and optimized to investigate the origin and the nature of ultra high energy cosmic rays, above 10^18 eV, using a hybrid detection technique. The surface array and the fluorescence detector provide complementary measurements of the extensive air showers. It has been taking data stably since January 2004, reaching an exposure of more than 20000 km2 sr yr. The latest results are presented, with particular emphasis given to the search for photons.

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The GAMMA-400 Space Experiment: Gammas, Electrons and Nuclei Measurements

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The present design of the new space gamma-ray telescope GAMMA-400 for the energy range 50 MeV - 3 TeV is presented. The proposed instrument has an angular resolution of 1-2 degrees at E(gamma) ~100 MeV and ~0.01 degrees at E(gamma) > 100 GeV and an energy resolution ~1% at E(gamma) > 100 GeV. By the mean of a deep segmented calorimeter high energy electrons flux can be studied, with a proton rejection factor of about 10^6. The GAMMA-400 experiment is optimized to address a broad range of science topics, such as search for signatures of dark matter, studies of Galactic and extragalactic gamma-ray sources, Galactic and extragalactic diffuse emission, gamma-ray bursts, as well as high-precision measurements of spectra of cosmic-ray high energy electrons, and protons and nuclei up to the knee.

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Study of the Galactic Gamma-ray Sources with VERITAS

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We report on recent galactic results and discoveries made by the VERITAS collaboration. The Very Energetic Radiation Imaging Telescope Array System (VERITAS) is a ground-based gamma-ray observatory, located in southern Arizona, sensitive to energies from 100GeV up to 30TeV. VERITAS has been fully operational since 2007 and its current sensitivity enables the detection of a 1% Crab Nebula flux at 5 sigma in under 30 hours. The observatory is well placed to view large parts of the galactic plane including its center, resulting in a strong galactic program. Objects routinely observed include Pulsars, Pulsar Wing Nebulae, X-ray binaries and sources with unidentified counterparts in other wavelengths.

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CORAM (COsmic RAy Mission): an outreach program 100 years after Pacini and Hess works

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The CORAM experiment is an outreach program carried on by researchers of the University of Salento and INFN Lecce in collaboration with several high schools of the Lecce region.
High School students and teachers are involved in the design, construction and test of a detector for the measurement of the cosmic ray flux as a function of the atmospheric depth.
The detector is made by scintillator layers readout by APDs (Avalanche Photo Diode) interleaved with iron absorbers and put into coincidence.
We present here the results of a test campaign using a first detector prototype that was carried at different altitudes up to 2100 m (Campo Imperatore, L'Aquila) and at the INFN Laboratori Nazionali del Gran Sasso.
The experiment might also be host on a atmospheric balloon.
The INFN encouraged and supported this outreach activity by funding the detector and Data Acquisition System (DAQ).

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Constraints on dark matter annihilation and decay in the Milky Way halo

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Indirect DM searches through Gamma rays produced in DM annihilation/decay in the Milky Way halo are promising means to test the WIMP paradigm due to the high DM density in the inner Galaxy and proximity of the target. Propagation of Galactic cosmic rays also produces diffuse gamma rays which represent a major foreground for these searches. In this talk we report results of an analysis in which we test the Fermi-LAT diffuse data for a contribution from a DM annihilation/decay signal by marginalizing over several parameters that determine the contribution from cosmic-ray-induced diffuse gamma-ray emission. We present competitive constraints from this analysis on the DM annihilation cross section and decay lifetime for several DM channels.

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Cosmic rays: interstellar gamma-ray and radio emission from our Galaxy

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Galactic cosmic rays (CR), interstellar gamma-ray emission and radio emission are related topics. CR electrons propagate in the Galaxy and interact with the interstellar medium, producing inverse Compton and bremsstrahlung

emission measured in gamma rays, and synchrotron emission measured in radio. After giving an overview of the latest results with Fermi on interstellar gamma-ray emission, I will focus on complementary studies of the radio emission from the Galaxy.
Using surveys over a wide range of radio frequencies and polarization measurements, we derive from synchrotron radiation constraints on the low-energy interstellar CR electron spectrum, magnetic fields, CR source distribution and Galactic halo size.

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The Fermi Large Area Telescope as a Cosmic-ray detector

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The Fermi Large Area Telescope (LAT) is an international observatory designed to study the high-energy gamma-ray sky. The gamma-ray events are identified and reconstructed from the signature of their electromagnetic showers in the instrument and it can therefore be used to observe cosmic-ray electrons and positrons thanks to its flexible triggering and filtering capabilities on-board. The Fermi LAT collaboration has published several results on charged cosmic rays. Among them is the measurement of the inclusive spectrum of electrons plus positrons (CREs) from 7 GeV to 1 TeV and searches for anisotropies in the CREs incoming direction. A recent measurement of cosmic-ray positron-only and electron-only spectra for energies between 20 GeV and 200 GeV was accomplished by using the Earth's magnetic field as a charge separator. In this talk we describe the techniques and capabilities of the LAT as a cosmic-ray detector and review the recent results and their interpretations. Prospects for future studies and observations will also be discussed.

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Constraining dark matter signal from a combined analysis of Milky Way satellites with the Fermi-LAT

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Dwarf spheroidal galaxies are considered very promising targets for dark matter searches in the gamma-ray band due to their large mass-to-light ratio and low astrophysical background. The gamma-ray signal is expected to be very faint, but a combined analysis of a set of dwarf galaxies improves the Fermi-LAT sensitivity to gamma-ray sources and yields enhanced constraints on the dark matter parameter space. From a combined analysis of Fermi-LAT data for 10 dwarf spheroidal galaxies, we derive robust constraints on the dark matter annihilation cross section for multiple channels, while accounting for statistical uncertainties in the astrophysical properties.

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A new survey technique at soft gamma-ray energies

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In the view of the so-called Active Galactic Nuclei (AGN) unified model the nuclear activity is powered by a super-massive black hole (SMBH) at the center of the AGN. An optically thick gas-dust structure surrounding the SMBH absorbs efficiently the nuclear radiation.
Current surveys of the INTEGRAL Soft-Gamma Ray Imager (IBIS/ISGRI) and of the Burst Alert Telescope (BAT) on board the Swift satellite have proven to be a powerful technique to detect AGNs at soft gamma-ray energies.
BAT and IBIS/ISGRI are coded-mask detectors having two major advantages: 1) they have a huge field of view, hence allowing to detect an large number of AGNs 2) they operate at soft gamma-rays, hence collecting photons that are energetic enough to pierce efficiently through the gas-dust structure surrounding the SMBH. However the sensitivity of coded-mask detectors is limited by heavy systematic uncertainties. Furthermore by design they block ~50% of the incident photons causing an increase of statistical noise. This prevents the detection of the most absorbed AGNs.
In this talk I will show that the BAT and the IBIS/ISGRI observations can be merged in order to produce a deep sky survey less susceptible to systematic and statistical noise. The survey of this virtual new mission extends over a wide sky area of 6200 deg^2 sampling 113 sources. The scientific outcome from the study of the sample has been properly addressed to study the evolution of AGNs in the local Universe. Our results are compared to other missions and predictions on future scheduled missions are made. I discuss also the expected results when applying this survey to the entire extragalactic sky and preliminary results of this survey on the Galactic center are shown.

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Propagation of extragalactic photons at ultra-high energy

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Ultra high energy photons, above 10^17-10^18 eV, may interact with the extragalactic background radiation leading to the development of electromagnetic cascades. A Monte Carlo code (ELECA) to simulate the electromagnetic cascades initiated by high-energy photons and electrons is presented. The main interaction processes (Pair Productions, Inverse Compton Scattering and Triple Pair Production) are treated with a full Monte Carlo approach while synchrotron energy losses and adiabatic losses are considered as continuous processes. Deflection in magnetic fields are taken into account as well. Results from simulations and their impact on the predicted flux at Earth are discussed in different scenarios.

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Anisotropy studies in proton flux with the PAMELA experiment

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Recent observations from PAMELA show that the cosmic ray proton spectrum does not follow a single power law model in the rigidity range between 1 GV to 1.2 TV. The spectrum gradually softens from 30 GV up to 230 GV but around ~240 GV the spectrum becomes harder. This observed behavior is in contradiction with the predictions of a shock diffusion acceleration model and diffusive acceleration in the galaxy.

Possible explanations rely on an indication of a different population of proton sources. Anisotropy studies can help to understand better the nature of the proton spectrum. The large Larmor radius at GV rigidity range make impossible to point back to proton sources but some large scale structures, reflecting the clustering of the sources, could be still present in the proton flux.

In this contribution we will study the proton arrival direction distribution with Pamela data. Large scale structures in the distribution of cosmic ray protons could be also caused by several different effects. The heliospheric magnetic field, which configuration is not well known, may be the responsible. The general large-scale structure of the heliomagnetic field may induce structures in primary cosmic rays flux as a function of the equatorial coordinates (sidereal anisotropy).
Magnetic fields in the neighborhood of the solar system are also influenced by the solar activity and reverse their polarity at each maximum of the activity. Additional cosmic-ray intensity variations may depend on the arrival direction with respect to the Sun. Also these effects will be discussed in this contribution.

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Capability for searching global anisotropies of ultra high energy cosmic rays with the Jem-Euso telescope

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The forthcoming Jem-Euso experiment will reach a huge exposure nearly uniform over the celestial sphere. These capabilities allow to discover relatively nearby sources of ultra high energy cosmic rays and to test their anisotropy.

Furthermore the full sky coverage makes possible to use in properly way the angular power spectrum analysis to determine the magnitude and the characteristic angular scale of the expected anisotropy. Infact only an observatory with full sky coverage can give an unbiased estimation of the angular power spectrum.

In this contribution the sensitivity of the observatory to the anisotropy of ultra high energy cosmic rays will be discussed.

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The Fermi LAT view of Cygnus: a laboratory to understand cosmic-ray acceleration and transport

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Cygnus X is a conspicuous massive star-forming region in the Local Spur of the Galaxy at ~1.4 kpc from the solar system. Gamma-ray observations can be used to trace cosmic rays (CRs) interacting with the ambient gas and low-energy radiation fields. Using the Fermi Large Area Telescope (LAT) we have discovered the presence of a 50-pc wide cocoon of freshly-accelerated CRs in the region bounded by the ionization fronts from the young stellar clusters. On the other hand, the LAT data show that the CR population averaged over the whole Cygnus complex on a scale of ~400 pc is similar to that found in the interstellar space near the Sun. We will discuss these results which confirm the long-standing hypothesis that massive star-forming regions host CR factories and which shed a new light on the early phases of CR life in such a turbulent environment.

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Cosmic Ray measurements in the region 1-100 TeV: combined proton and helium spectrum.

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The ARGO-YBJ experiment, located in the Yangbajing Cosmic Ray observatory (4300 m a.s.l. Tibet, P.R. China), detects Extensive Air Showers in a wide energy range by means of a full-coverage detector which is in stable data taking since November 2007. In this work recent results about the measurement of the combined proton and helium spectrum in the energy range 5-200 TeV are presented. The ARGO-YBJ results are therefore the first indirect measurements at these energies with ground-based detectors. The measured spectrum can be compared to direct measurements in the same energy region. The data show a good agreement with recent direct measurement and suggest that the spectrum is harder than in the low energy region.

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Status and updates from the High Altitude Water Cherenkov (HAWC) Observatory

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The High Altitude Water Cherenkov Observatory (HAWC) is currently being deployed on the slopes of Volcan Sierra Negra, Puebla, Mexico. The HAWC observatory will consist of 300 Water Cherenkov Detectors totaling approximately 22,000 m^2 of instrumented area. The water Cherenkov technique allows HAWC to have a nearly 100\% duty cycle and large field of view, making the HAWC observatory an ideal instrument for the study of transient phenomena. With its large effective area, excellent angular and energy resolutions, and efficient gamma-hadron separation, HAWC will survey the TeV gamma ray sky, measure spectra of galactic sources from 1 TeV to beyond 100 TeV, and map galactic diffuse gamma ray emission. The science goals and performance of the HAWC observatory as well as how it will complement contemporaneous space and ground-based detectors will be presented.

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Searching for the gamma-ray emission of HESS J0632+057

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In the last decade Cherenkov telescopes on the ground and space-based gamma-ray instruments have identified a new class of high mass X-ray binaries (HMXB), whose emission is dominated by gamma rays. To date only five of these systems are known. All of them are detected by Cherenkov telescopes in the TeV energy range, while at GeV energies there is still one (HESS J0632+057) that has no reported detection with the Fermi LAT. A deep search for gamma ray emission of HESS J0632+057 has been performed using more than 3.5 years of Fermi-LAT data. We discuss the results of this search and compare it to other gamma-ray binary systems.

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Solar and stellar inverse Compton emission: a software package

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The importance of inverse-Compton emission from interactions of cosmic-ray electrons and positrons on the photon field of the Sun (and also individual stars) was first realized around 2006.
Following the discovery of solar emission from the quiet sun in EGRET data, now Fermi-LAT is so sensitive that even such weak emission can be detected with high significance and studied in detail. This potentially allows the propagation of leptons in the inner heliosphere to be investigated, which is otherwise impossible.
Solar inverse Compton is also important as a background over the entire sky to be accounted for in studies of Galactic and extragalactic gamma-ray emission.

Hence, a general software package that provides a flexible model of the solar emission is useful to assist in interpreting such data. We present here our C++ software to compute inverse-Compton scattering from the heliosphere, as well as the photospheres of stars. It includes a formulation of modulation in the heliosphere, but can be used for any user-defined modulation model. It outputs profiles, spectra and differential flux to FITS files in a variety of forms for convenient use.
The software is publicly available and is
under continuing development, taking into account updated observations in gamma rays and cosmic rays. It uses general-purpose inverse-Compton routines with other features like energy loss rates and emissivity for any user-defined target photon and lepton spectra.

We will present the software and show examples of predictions for the solar inverse Compton, pointing out interesting features which should be the object of future data analyses.

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Search and Characterization of Radio-quiet Gamma-ray Pulsars with Fermi-LAT

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The Fermi Large Area Telescope (LAT) has opened a new era for pulsar astronomy. Besides improving our understanding of known pulsars and triggering the discovery of new radio pulsars, it has uncovered a whole population of radio-quiet gamma-ray pulsars. I will describe the techniques used to find such pulsars from gamma-ray data alone and review the results obtained so far with these techniques. I will present a study of the LAT sensitivity to pulsations and use it to constrain the overall pulsar population. I will show the capabilities of the LAT to time pulsars across glitches using gamma-ray data alone. Finally, I will present recent attempts to extend our search techniques to millisecond pulsars in binary systems, with special emphasis on the black widow candidate 2FGL J2339.6-0532.

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VHE emission from extragalactic sources: open issues from MWL observations

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The Cherenkov telescopes observations together with with Fermi/LAT survey and multi-wavelength (MWL) simultaneous coverage are posing new challenges to the description of extreme sources, such as blazars, flat spectrum radio quasars (FSRQs), and radiogalaxies.

We will review some of these new results threatening the conventional emission models. Among them: the difficulties of the usual description with single-zone SSC models of the SED of BL Lacs objects, when simultaneous very-high energy (VHE) and MWL observations are taken into account; the constraints on the location of the gamma-ray emission region as revealed by the MAGIC observations of the FSRQ PKS 1222+21; the unprecedented activity recently detected on the BL Lac PG 1553+113; the firm VHE detection of somewhat unexpected sources such as the radiogalaxy NGC 1275 and IC 310 in the Perseus cluster of galaxies.
We will also consider the interplay between intrinsic emission models and the interaction of gamma-rays with the extragalactic background light and intergalactic magnetic fields.

In this talk these issues will be tackled in the framework of the results of MWL observations led by the MAGIC Cherenkov telescopes system.

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Propagation and Spectrum of Ultra High Energy Cosmic Rays

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A general review on the propagation of Ultra High Energy Cosmic Rays (UHECR) in astrophysical backgrounds will be presented, with particular emphasis on the comparison among theoretical models and recent observations by the Pierre Auger Observatory. In particular, the observed spectrum and chemical composition of UHECR will be discussed in connection with the theoretical aspects of the propagation of these extremely energetic particles.

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Generation of particles, neutrino and fotons in magnetosphere of collapsing star

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The generation of the particles, photons and neutrino in the magnetosphere of collapsing stars is considered. The initial magnetospheres of collapsing star consist with protons and electrons. These particles accelerate during collapse to relativistic energy. Interacting among themselves and the magnetic fields in magnetosphere, these particles will lose their energy on the ionization and radiation. Electrons will be loss the energy with the most speed, and therefore the electrons lifetime is substantially smaller from the protons lifetime. As result the initial electrons will be loss their energy very fast. At the same time in the magnetosphere of collapsing stars will generate the secondary particles namely electrons, protons, neutrons, mesons, neutrino and photons. During the cascade interaction the secondary particles will generate the other particles and photons. Thus on the later stage of collapse the magnetosphere of collapsing stars consist with the particles and photons generating by multiple interaction of particles.

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BEAMING NEUTRINO AND ANTINEUTRINOS ACROSS THE EARTH TO DISENTANGLE NEUTRINO MIXING PARAMETERS

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A MINOS result (MINOS Collaboration 2010) seemed to hint a different anti-neutrino mass splitting and mixing angle with respect to the neutrino ones, offering a hint for a CPT violation in lepton sector. However more recent MINOS data (MINOS Collaboration 2012) reduced the neutrino anti-neutrino differences leading to a narrow discrepancy almost compatible with no CPT violation, hard to be disentangled. Moreover last a few years of OPERA activity on tau appearance is still unprobed (one unique event). Both flavor muon-tau mixing, tau appearance and eventual CPT violation disentanglement need more tools
to be enhanced. Atmospheric muon neutrino spectra and anisotropy in Deep Core at ten-tens GeV (yet unpublished) may test the muon-tau conversion but they can hardly reveal such last tiny MINOS CPT asymmetry. We show how the longest baseline neutrino oscillation available, crossing most of the Earth diameter, within an OPERA-like experiment from CERN (or FermiLAB) to ICECUBE-DeepCore detector at 21 GeV energy, may at best disentangle even last tiny CPT violation (within 6 sigma a year) while testing at highest rate , tau appearance. We propose a beam of muon neutrino and antineutrino through the Earth to test their disappearance or (for any CPT violation) the partial muon neutrino appearance at the longest distances Such a tuned detection experiment may lead also to a clear and strong signature of tau or anti-tau generation (even within its neutral current noise

background events): nearly one anti tau or two tau a day, even within a mini OPERA-like test whose tunnel and whose flux is just one percent the corresponding OPERA experiment.

The gamma-ray sky / **31**

The First Fermi LAT Catalog of Supernova Remnants

Author: Francesco De Palma[1]

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The Fermi Gamma-ray Space Telescope has shed new light on many types of Galactic objects, including Supernova Remnants (SNRs). With over 15 SNRs identified to date and over 40 candidates in the 2nd Fermi Gamma-ray LAT (2FGL) Catalog, we are beginning to have sufficient numbers to perform GeV SNR population studies and explore their connection to TeV emission. Moreover, with the wealth of multi-wavelength data available, we can now characterize the GeV emission in all regions containing known SNRs in a uniform and consistent manner. This permits the first systematic study of SNRs including GeV data, allowing us to classify SNRs and to separate effects of evolution and environment. In combination with multi-wavelength data, we can constrain emission models of the underlying particle populations, allowing us to quantify SNRs' aggregate contribution to Galactic cosmic rays in a statistically significant manner. We will present preliminary results of this first Fermi LAT catalog of SNRs.

The cosmic-ray sky as seen from space / **32**

Origin of Galactic Cosmic Rays

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I will describe the current status of the understanding of the acceleration and propagation of Galactic cosmic rays and discuss some recent observational results on the spectrum, composition and anisotropy of these particles. Special attention will be devoted to successes and problems of the so-called supernova remnant paradigm for the origin of cosmic rays, in the light of the recent gamma ray observations of several remnants. I will also briefly address the question of the transition from Galactic to extra-galactic cosmic rays.

The gamma-ray sky / **33**

Supergiant Fast X-ray Transients as best candidate counterparts of galactic unidentified gamma-ray transients

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In the last few years Fermi and AGILE observations have indicated the existence of a possible population of gamma-ray transients located on the galactic plane and characterized by fast flares lasting

only a very few days. Notably, no blazar-like counterparts are known within their error boxes so they could represent a completely new class of galactic fast gamma-ray transients. The task of identifying their counterparts at lower energies remains very challenging. Despite this difficulty, recent INTEGRAL results have provided intriguing hints that reliable best candidate counterparts could be found among the members of the recently newly discovered class of Supergiant Fast X-ray Transients (SFXTs).
In this context, I will present INTEGRAL results on the candidate SFXT IGRJ17354-3255. Such results strongly suggest that IGR J17354-3255 is the best candidate counterpart of the spatially associated unidentified gamma-ray transient AGL J1734-3310. I will discuss the possible physical link between the two sources and implications stemming from this association.

Future Projects / **34**

An overview of the JEM-EUSO mission

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JEM-EUSO will be the first observatory to explore from space the
universe at ultra-high energies. Hosted on the JEM platform on board the
ISS, it will use an innovative refractive optics and sophisticated focal
surface to observe the UV fluorescence light emitted, in the 320-400 nm
band, by extensive air showers generated by primary particles interacting
in the atmosphere. The telescope will achieve an unprecedentedly large
effective aperture and a very uniform exposure in declination over
the whole celestial sphere, which are beyond the capabilities of present
ground-based observatories. The main scientific objectives will include the
measurement of the energy spectrum at the highest energies of the cosmic ray
spectrum, including the yet unexplored region of a possible recovery, and anisotropy studies
with large statistics which will allow for the possibility of
point-source charged-particle astronomy. In this presentation,
the status of the mission, its scientific potential and performance will be reviewed.

The cosmic-ray sky as seen from space / **35**

Direct measurements of cosmic rays in space

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Direct measurements of the chemical composition and fluxes of cosmic rays have
always played a crucial role in advancing our understanding of both acceleration and
propagation of cosmic rays. Direct detection is performed with three basic technologies: balloon-borne and satellite-borne detectors, and instruments placed aboard space stations.
In this talk I will present the basic principles of direct detection and review the most important measurements made by past and present missions, with a view to future projects.

The cosmic-ray sky as seen from ground (or below) / 36

Neutrinos searches with the IceCube telescope

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The IceCube Neutrino Observatory is a kilometer-scale detector located in the South Pole. The full detector comprises 5,160 photomultipliers deployed along 86 strings at depths between 1.5-2.5 km in the ice. Muon tracks arriving in the detector from neutrino interactions are reconstructed using the time and charge information detected by the array of PMTs. In this contribution we present the latest results of time-integrated and time-dependent searches for astrophysical neutrino sources. The entire sky is scanned for accumulations of neutrino signal events incompatible with the atmospherical background.
The detection of these astrophysical neutrinos will help to settle the unresolved questions about the origin and nature of cosmic rays. Among possible sources of neutrino emissions blazars are one of the main candidates. Assuming that neutrinos and γ-rays are produced in dominant pp or pγ interactions and that the total power in them equals, IceCube limits and Fermi observations can be used to constrain the main parameters of these hadronic models.

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UVSiPM: a light detector working in Single Photon Counting based on SiPM sensor.

Author: Giovanni La Rosa[1]

Co-authors: Alberto Segreto [2]; Alessandro Grillo [3]; Angelo Mangano [2]; Benedetto Biondo [2]; Davide Marano [3]; Domenico Impiombato [2]; Elisabetta Strazzeri [2]; Francesco Russo [2]; Gaetano Agnetta [2]; Giovanni Bonanno [3]; Giuseppe Sottile [1]; M.C. Maccarone [2]; Mariacristina Timpanaro [3]; Massimiliano Belluso [3]; Osvaldo Catalano [2]; Salvatore Giarrusso [2]; Sergio Billotta [3]; Teresa Mineo [2]

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UVSiPM is a stand-alone portable photon detector instrument to measure electromagnetic radiation in the 320—900 nm wavelength range.
It has been developed in the framework of the ASTRI project, a MIUR flagship project lead by INAF and focused on the realization of an end-to-end prototype Cherenkov telescope for the CTA (Cherenkov Telescope Array).
The UVSiPM instrument is composed by a SiPM sensor, based on Hamamatsu S11828-3344M device, an electronic chain working in single photon counting with 10 ns double pulse resolution, and a collimator to regulate the angular aperture of the detector.
UVSiPM, with his peculiar characteristic, will permit to perform several measurements both in Lab and on field, devoted to the characterization and calibration purposes of the ASTRI telescope prototype, whose camera on the focal plane is composed by a grid of SiPM sensors.

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Characterization of the front-end EASIROC for read-out of SiPM in ASTRI camera

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ASTRI (Astrofisica con Specchi a Tecnologia Replicante Italiana), a flagship project of the Italian Ministry of Education, University and Research, is a prototype for the small-size telescopes of the Cherenkov Telescope Array (CTA).
ASTRI will adopt a wide field optical system in a Schwarzschild-Couder configuration to explore the VHE range (1-100 TeV) of the electromagnetic spectrum.
The camera at the focal plane is based on Silicon Photo-Multiplier (SiPM) detectors which is an innovative solution for the detection of Cherenkov light that requires high sensitivity in the 300-700 nm band and fast temporal response.

SiPMs can be read by the Extended Analogue Silicon Photo-Multiplier Integrated Read Out Chip (EASIROC) that is equipped with 32-channels each with the capability of measure charge from 1 to 2000 photoelectrons with a SiPM gain of 10^6.

In this poster, we report some preliminary result of measurements of EASIROC output analogue signal to evaluate the capability of autotriggering. In particular we present our results on the trigger time walk and jitter of the output signal; on the DAC linearity; on the trigger efficiency vs the injected charge. Moreover, we report also on the dinamic linearity range of the output analogue signal of the chip.

The gamma-ray sky / 39

Supernova remnant studies with Fermi-LAT

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Long thought to be capable of supplying the high energy cosmic rays in the Galaxy, supernova remnant (SNRs) are ideal sites to study cosmic-ray acceleration. Here I present recent results from Fermi-LAT, including the detection of the SNR Puppis A. Extended gamma-ray emission from the remnant is found to match the IR and X-ray morphology. Applying knowledge of the photon field and ambient density from multi-wavelength data allows detailed modeling of the origin of very high energy gamma-ray emission. Such multi-wavelength modeling improves our general understanding of these SNRs, and the physical parameters crucial to understanding particle acceleration and diffusion. I will also explore ways in which multi-wavelength data can be utilized to classify GeV detections in the Fermi-LAT Catalog of SNRs. A large sample of identified SNRs is needed for a comparative study of particle acceleration, probing the origins of cosmic rays.

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Study of blazar AO0235+164 during multi-wavelength observation period in 2008-2009

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AO 0235+164 is one of the most-studied and monitored BL Lac objects in the sky. Since the launch of Fermi, the source has been monitored in the gamma-ray band by Fermi-LAT.Starting from October 2008, AO0235+164 showed an increasing activity in gamma-rays that led to a multi-wavelength campaign with instruments in the radio, near-infrared, optical, UV and X-rays bands. We present here the results of the analysis of the multi-wavelength data collected during the flaring period: the high variability properties of this source and the SED built from radio frequencies to gamma-rays are shown.

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Spatial correlation studies applied to gamma/hadron discrimination in the ARGO-YBJ experiment

Authors: Michele Iacovacci[1]; Xiaoxiao Li[2]

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While Cherenkov telescopes have been successful in identifying the gamma showers thanks to their ability to measure the shower image produced by Cherenkov photons, the air shower arrays which measure just charged particles, with no muon identification, still suffer from inability to discriminate gamma induced showers. As an example the ARGO-YBJ experiment is getting its results without any gamma/hadron separation, just basing on the pointing accuracy. Following recently proposed approaches, spatial correlations among secondary charged particles in extensive air showers have been studied for the case of ARGO-YBJ, which represents a particularly suited detector in this respect because of its "continuous-carpet"geometry. Two different types of statistics have been considered, namely the nearest-neighbour spacing distribution (NNSD) and the variance of the number of secondary particles at given distance. The results of this investigation will be reported.

One century of cosmic ray studies / 42

Studies and measurements before 1912

Author: Alessandro De Angelis[1]

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Early measurements from Pacini and others

One century of cosmic ray studies / 43

The Hess balloon flights

Author: Michael Walter[1]

[1] *DESY*

Review of the measurements of V. Hess and collaborators

One century of cosmic ray studies / **44**

The history of cosmic ray studies after Hess

Author: Claus Grupen[1]

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Cosmic rays after Hess is the birthplace of elementary particle physics. The 1936 Nobel prize was shared between Victor Hess and Carl Anderson. Anderson discovered the positron in a cloud chamber. The positron was predicted by Dirac several years earlier, but Anderson was not aware of it. In his subsequent cloud chamber investigations Anderson found - together with Neddermeyer - the muon, which for some time was considered to be a candidate for the Yukawa particle responsible for nuclear binding. Only emulsion measurements by Perkins, Powell, Occhialini and Muirhead clarified the situation by the discovery of the charged pions in cosmic rays. The cloud chamber continued to be a powerful instrument in cosmic ray studies. Rochester and Butler using the cloud chamber of the Blackett group in Manchester found Vs, which turned out to be shortlived neutral kaons decaying into a pair of charged pions. Also s were found in cosmic rays. But after that the period of accelerators and storage rings took over. The unexpected renaissance of cosmic rays started with the search for solar neutrinos and the observation of the supernova 1987A. With the observation of neutrino oscillations one began to look beyond the standard model of elementary particles. Interesting results from X-ray and gamma-ray astronomy and the detailed observations of the cosmological background radiation disclosed that we are living in a universe dominated by dark matter and dark energy. After 100 years of cosmic ray research we are at the beginning of a new era, and we still aim "To understand what holds the core of the world together".

One century of cosmic ray studies / **45**

The history of gamma ray studies

Author: Razmik Mirzoyan[1]

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The history of gamma ray astronomy is reviewed

One century of cosmic ray studies / **46**

The status of current research: theory

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The theoretical aspects of the study of the cosmic radiation will be reviewed.

One century of cosmic ray studies / **47**

The status of current research: experiments

Author: Roberto Battiston[1]

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Current experimental studies of the cosmic radiation will be reviewed

The cosmic-ray sky as seen from space / **48**

The AMS-02 Experiment: one year in space

Author: Cecilia Pizzolotto[1]

[1] *INFN Perugia*

The Alpha Magnetic Spectrometer (AMS) is a precision particle physics magnetic spectrometer designed to measure electrons, positrons, gamma rays and various nuclei and anti-nuclei from the cosmos up to TeV energy ranges. It was delivered to the International Space Station onboard space shuttle Endeavour and installed on May 19, 2011. Since that time, more than 14 billion cosmic ray events have been collected, we will report on the flight operations and performance of AMS-02 and its perspective for physics measurements.

The gamma-ray sky / **49**

Gamma ray astronomy with ARGO-YBJ

Author: Silvia Vernetto[1]

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ARGO-YBJ is an extensive air shower detector located in Tibet at 4300 m a.s.l.
The detector features and location allow the study of gamma-ray sources with a few hundreds GeV energy threshold and very large duty cycle.
Results so fare obtained will be reviewed.

The cosmic-ray sky as seen from ground (or below) / **50**

Review of indirect cosmic ray measurements

Author: Andrea Chiavassa[1]

[1] *Univ. of Torino and INFN*

In this talk I will review the main results obtained by ground based experiments detecting the extensive air showers generated in atmosphere by the interaction of primary cosmic rays.
I will show the latest results about the anisotropy, the primary spectrum and the chemical composition in the energetic range 10^12-10^20 eV. As the energetic interval is huge experiments operate at different heights above see level, cover different surfaces and use different techniques.
I will discuss the shared features and the differences of these measurements, pointing out the experimental results expected in the near future.

Future Projects / **51**

The Cerenkov Telescope Array (CTA)

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The CTA project will be reviewed.

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Evidence of geomagnetic effect on the azimuthal distribution of cosmic rays

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The geomagnetic field causes not only the East-West effect on the primary cosmic rays but also affects the trajectories of the secondary charged particles in the shower, causing their lateral distribution to be stretched. Thus both the density of the secondaries near the shower axis and the trigger efficiency of detector arrays decrease. The effect depends on the direction of the showers, thus involving the measured azimuthal distribution. The non-uniformity of the azimuthal distribution of the events collected by the ARGO-YBJ detector is deeply investigated for different zenith angles in the light of this effect.

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Future Projects / **55**

The Gamma Light project

Author: Aldo Morselli[1]

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The gamma light project will be described

The cosmic-ray sky as seen from ground (or below) / 56

Cosmic Ray Physics with ARGO-YBJ

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The results so far obtained by the ARGO-YBJ experiment in the study of the cosmic ray flux will be discussed together with the prospects for future achievements.

The gamma-ray sky / 57

AGILE study of Supernova Remnants

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AGILE study of Supernova Remnants

The gamma-ray sky / 58

AGILE and ASDC

Author: Carlotta Pittori[1]

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AGILE and ASDC

The gamma-ray sky / 59

GRB emission: status and questions

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GRB emission: status and questions

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LHAASO

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Future Projects / **61**

The LHAASO project

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The LHAASO project will be described

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Future Projects / **63**

Science with the ASTRI prototype

Author: Nicola SARTORE[1]

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ASTRI is a flagship project of the italian Ministry of Instruction, University and Research and represents the italian proposal for the development of the Small Scale Telescope (SST) system of the Cherenkov Telescope Array (CTA), which is the planned next generation observatory for very high energy gamma-rays (20 GeV - 100 TeV).

The ASTRI (Astrofisica a Specchi con Tecnologia Replicante Italiana) end-to-end prototype will be installed at Serra La Nave (Catania, Italy) and will see its first light in 2014.
We describe the expected performance of the prototype on few selected test cases of the northern emisphere.
The aim of the prototype is to probe the technological solutions and the nominal performance of the various telescope's subsystems

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Summary talk

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Summary talk

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Final Information and acknowledgements

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SciNeGHE past and future