AtmoHEAD: Atmospheric Monitoring for High-Energy Astroparticle Detectors

Report of Contributions

Contribution ID: **0** Type: **Talk**

The Atmospheric Monitoring system of the JEM-EUSO telescope

Wednesday, 12 June 2013 14:05 (35 minutes)

The JEM-EUSO observatory on board of the International Space Station (ISS) is a new concept of Space mission devoted to the investigation of Ultra High Energy Cosmic Rays (UHECRs). Looking downward to the Earth atmosphere the JEM-EUSO telescope will detect the fluorescence and Cherenkov UV emission from UHECRs induced Extensive Air Showers (EAS) penetrating in the atmosphere within a 60◦ Field of View (FoV). The capability to reconstruct the properties of the primary cosmic ray depends on the accurate measurement of the atmospheric conditions in the region of EAS development. The Atmospheric Monitoring system of JEM-EUSO will continuously monitor the atmosphere at the location of the EAS and between the EAS and the JEM-EUSO telescope with an UV LIDAR and an Infrared (IR) Camera. The system will be able to monitor the cloud coverage and to retrieve the cloud top altitude with an accuracy of approx. 500 m and the optical depth profile of the atmosphere with accuracy of $\Delta\tau \leq 0.15$ and a resolution of 500 m.
In this contribution the Atmospheric Monitoring system of JEM-EUSO, mainly focusing on the LIDAR, will be presented. After a brief description of the system, the capabilities in recovering cloud optical depth and shower profile based on simulation studies will be shown.

Primary author: Dr TOSCANO, Simona (University of Geneva)

Co-authors: Prof. NERONOV, Andrii (Univeristy of Geneva); Prof. RODRIGUEZ FRIAS, Maria Dolores (SPace & AStroparticle (SPAS) Group, UAH); Prof. WADA, Satoshi (RIKEN)

Presenter: Dr TOSCANO, Simona (University of Geneva)

Session Classification: Wednesday afternoon 1

Track Classification: Monitoring facilities under development

Contribution ID: **1** Type: **Talk**

Improvements to the Infrared Cloud Detection System at the Pierre Auger Observatory

Atmospheric cloud cover is an important parameter for many scientific experiments. At the Pierre Auger Observatory the precise locations of clouds, in the field of view of fluorescence detectors, is required to accurately reconstruct the energies and directions of cosmic ray air showers. To improve the current cloud detection system at the Pierre Auger Observatory, Gobi-384 uncooled radiometric microbolometer array infrared cameras, are being Implemented. These radiometric infrared cameras allow for sky and cloud brightness temperature measurements, which can be used to improve cloud detection methods by taking advantage of the absolute infrared signal and not just the differential signal. The possibly of understanding aspects of the physical structure and properties of the atmosphere at the Observatory may also be possible with these new cameras.

Primary author: Mr GRUBB, Trent (The University of Adelaide)

Presenter: Mr GRUBB, Trent (The University of Adelaide)

Track Classification: Monitoring facilities under development

Contribution ID: **2** Type: **Talk**

The Site of the ASTRI SST-2M Telescope Prototype: atmospheric monitoring and auxiliary instrumentation

Tuesday, 11 June 2013 12:00 (30 minutes)

ASTRI ("Astrofisica con Specchi a Tecnologia Replicante Italiana") is a Flagship Project financed by the Italian Ministry of Education, University and Research, and lead by the Italian National Institute of Astrophysics, INAF. Primary goal of the ASTRI project is the design, development and construction of an end-to-end prototype of a Small Size Telescope for the CTA (Cherenkov Telescope Array) in a dual-mirror configuration (SST-2M), equipped with a camera at the focal plane composed by an array of multi-pixel Silicon Photo-Multipliers, and devoted to the investigation of the highest gamma-ray energy band.
The ASTRI SST-2M prototype will be placed at the INAF "M.G. Fracastoro" observing station in Serra La Nave, 1735 m a.s.l. on the Etna Mountain near Catania, Italy.
We present the Serra La Nave site, its weather and sky conditions, and the complex of auxiliary instrumentation that will be used on site to support the calibration and science verification phase of the ASTRI SST-2M prototype.

Primary author: Dr LETO, Giuseppe (INAF-Catania Astrophysical Observatory)

Co-author: Dr MACCARONE, Maria Conettta (INAF - IASF Palermo)

Presenters: Dr LETO, Giuseppe (INAF-Catania Astrophysical Observatory); Dr MACCARONE, Maria Conettta (INAF - IASF Palermo)

Session Classification: Tuesday morning 2

Track Classification: Monitoring facilities under development

Contribution ID: **3** Type: **Talk**

Elve observation with the Fluorescence Detectors of the Pierre Auger Observatory

Wednesday, 12 June 2013 09:30 (35 minutes)

The elves are transient luminous events triggered by cloud-to-ground lightning return strokes. These events appear as rapidly expanding rings along the lower boundary of the ionosphere, on timescales of the order of 1 ms. The Fluorescence Detectors of the Pierre Auger Observatory can provide 3D imaging of elves with an unprecedented resolution. A dedicated trigger has been designed based on 60 elve candidates, recorded by chance as part of a prescaled sample (1 in a 100) of minimum bias events that did not contain usable air shower data. In this contribution a detailed description of the trigger, and an analysis of the first events collected is presented.

Primary author: Dr TONACHINI, Aurelio Siro (Università degli Studi di Torino, ITALY)

Co-author: OBSERVATORY, The Pierre Auger (The Pierre Auger Observatory)

Presenter: Dr TONACHINI, Aurelio Siro (Università degli Studi di Torino, ITALY)

Session Classification: Wednesday morning 1

Track Classification: Aerosols and interdisciplinary studies

Contribution ID: **4** Type: **Talk**

Mineral Dust from Patagonia plays an important role in the amount of atmospheric dust transported in the Southern Hemisphere

Wednesday, 12 June 2013 10:05 (35 minutes)

Mineral dust transported form desert areas is ubiquitous in tropical and sub-tropical regions where arid and semi-arid deserts constitute an important source for this natural aerosol. At southern mid- and high-latitudes, the concentrations of mineral dust are less important, but it plays an important role to provide trace metals for phytoplankton in the oceans. The austral region between 40 and 65°S is recognized for its importance as a sink for CO2.
Patagonia is a major source of mineral dust for the Southern Hemisphere. During past cold periods, the main sources of aerosols measured at South Pole are arid regions over Patagonia. We will explain how a concerted effort to use atmospheric measurements and modeling techniques, that trace the concentration and deposition of mineral dust at the global scale, will help us study the role of mineral dust in the austral regions.

Primary author: Dr BALKANSKI, Yves (IPSL/LSCE)

Co-authors: Dr JOURNET, Emilie (IPSL/LISA); LOSNO, Rémi (IPSL/LISA)

Presenter: Dr BALKANSKI, Yves (IPSL/LSCE)

Session Classification: Wednesday morning 1

Track Classification: Aerosols and interdisciplinary studies

Contribution ID: **5** Type: **Talk**

Aerosol characteristics at VERITAS

Monday, 10 June 2013 12:10 (30 minutes)

The stereoscopic Imaging Atmospheric Cherenkov Telescope array of VERITAS, situated at the F.L. Whipple Observatory administrative complex at the foot of the Santa Rita Mountains in southern Arizona, operates in the energy range between 100 GeV and 30 TeV.

The VERITAS collaboration engages in wide-ranging scientific and observational programs in the areas of galactic and extra-galactic gamma-ray emitters, in addition to measurements of the extra-galactic background light and the search for astrophysical dark matter among others. All of the mentioned programs are dependent on accurate calorimetry and effective area estimates for spectral energy distribution plots and other scientific studies. Currently we estimate the systematic error in energy reconstruction of individual events to be of the order of 20%.

Present re-evaluation of atmospheric data, thanks to the introduction of a continuous operation 905nm ceilometer at the administrative complex since December 2011, has introduced the possibility of more accurate determination of the atmosphere's aerosol constituency at lower stratospheric, tropospheric and boundary layer levels. The proposed talk aims to present detailed interpretation of contemporaneous atmospheric data from IR cameras, ceilometer and the telescope array itself and assess if more accurate modeling can be achieved, with the ultimate aim of future implementation into radiative transfer simulations.

Primary author: CONNOLLY, Michael (NUI Galway)

Presenter: CONNOLLY, Michael (NUI Galway)

Session Classification: Monday morning

Track Classification: Monitoring facilities in operation

Contribution ID: **6** Type: **Talk**

Aerosol effect on multiple scattering for light propagation in the atmosphere

Monday, 10 June 2013 17:30 (30 minutes)

When cosmic rays enter the atmosphere, they induce extensive air showers composed of secondary particles. Charged particles excite atmospheric nitrogen molecules, and these molecules then emit fluorescence light in the 300-400 nm range. In cosmic ray observatories as the Pierre Auger Observatory or Telescope Array, the atmosphere is used as a giant calorimeter, where the fluorescence light is proportional to the energy deposited by the shower. The main atmospheric attenuation processes are Rayleigh scattering, by the molecular component, and Mie scattering, by the aerosol component, both being elastic. In this work, we show how the multiple scattering can also contribute to the light recorded by the fluorescence telescopes. Since the aerosol population is highly variable in time and location, multiple scattering with different aerosol conditions will be presented. All these results will be given in the case of an isotropic point source.

Primary author: COLOMBI, Joshua (LPSC, CNRS/IN2P3, UJF-INPG)

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Presenter: COLOMBI, Joshua (LPSC, CNRS/IN2P3, UJF-INPG)

Session Classification: Monday afternoon 2

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **7** Type: **Talk**

All Sky Camera instrument for night sky monitoring

Monday, 10 June 2013 13:45 (30 minutes)

The All Sky Camera (ASC) was developed as an universal device for a monitoring of the night sky quality and night sky background measurement. ACS system consists of an astronomical CCD camera, a fish eye lens, a control computer and associated electronics.
The measurement is carried out during astronomical twilight. The analysis results are the cloud fraction (the percentage of the sky covered by clouds), night sky brightness (in mag/arcsec2) and light background in the field of view of UHECR instruments.
The analysis of the cloud fraction is based on the astrometry (comparison to catalogue positions) of the observed stars, the algorithm for derivation of the night sky brightness, and examples of obtained results.
The instrument is used within Pierre Auger Collaboration and CTA Site Selection Work Package.

ASC camera consists of MII G1-2000 camera Moravian Instruments), Fujinon objective YV2.2x1.4A-SA2 and electronics.
Original picture resolution is 2 Mpix – 16 bit depth, monochrome
The algorithm to calculate the cloud fraction compares the stars found in the image and their visible counterparts from a star catalogue (angular distance is typically less than 0.5 degree).
The system is more versatile, it could generate cloud fraction of a chosen sky region to drive a robotic telescope, measure the night sky background of a chosen sky region calibrated to a custom instrument etc.

Primary author: Dr MANDAT, Dusan (Institute of Physics of Academy of Science of The Czech Republic)

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Presenter: Dr MANDAT, Dusan (Institute of Physics of Academy of Science of The Czech Republic)

Session Classification: Monday afternoon 1

Track Classification: Monitoring facilities in operation

Contribution ID: **8** Type: **Talk**

Raman LIDARs for the Cherenkov Telescope Array Observatory

Wednesday, 12 June 2013 11:45 (45 minutes)

The Cherenkov Telescope Array (CTA) is the next generation of Imaging Atmospheric Cherenkov Telescopes (IACTs). It would reach a sensitivity and an energy resolution never seen before in very high energy gamma-ray astronomy. In order to achieve this goal, the systematic uncertainties derived from the atmospheric conditions shall be reduced to the minimum. Different instruments may help to account for these uncertainties. In this case, the Barcelona IFAE and UAB groups, and the LUPM in Montpellier are building Raman LIDARs, devices which can reduce the systematic uncertainties in the reconstruction of the gamma-ray energies from a 20% down to less than 5%. The Raman LIDARs subject of this work, are coaxial 1.8 m mirrors and Nd-YAG lasers. A liquid light-guide collects the light at the focal plane and transports it to the readout system. A monocromator, a device composed of a system of filters and a single photomultiplier centered on one elastic channel, is being developped with the purpose of testing the readout chain of the LIDAR. After characterizing the system, a polychromator will be built in order to also collect the sparse Raman signal, which needs to be optimized to reduce every possible loss of signal.

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Presenter: DORO, Michele (University of Padova and INFN)

Session Classification: Wednesday morning 2

Track Classification: Monitoring facilities under development

Contribution ID: **9** Type: **Poster**

Influence of atmospheric aerosols on the performance of the MAGIC telescopes

Tuesday, 11 June 2013 15:00 (5 minutes)

We investigate the performance of the MAGIC telescopes under three simulated atmospheric conditions: an increased aerosol content in the lower part of the troposphere, the presence of a cloud and an extremely clean atmosphere. We find that the effective area of the telescopes system is gradually reduced in the presence of varying concentrations of aerosols whereas the energy threshold rises. Clouds at different heights produce energy-dependent effects on the performance of the system. A clear correlation between total atmospheric transmission at 385nm and energy bias, energy threshold and reconstructed spectral index, respectively, is found, separately for each aerosol layer height. Based on these findings, a correction method could be developed for the case that atmospheric transmission and cloud altitude are measured during the observations. The method can be applied to increase the duty cycle of any other imaging Cherenkov telescope including the next generation Cherenkov Telescope Array.

Primary author: Mr DANIEL, Garrido Terrats (Universitat Autònoma de Barcelona)

Co-authors: MORALEJO, Abelardo (IFAE); Prof. FONT, Lluís (Universitat Autònoma de Barcelona); Dr GAUG, Markus (Universitat Autònoma de Barcelona); DORO, Michele (University of Padova and INFN)

Presenter: Dr GAUG, Markus (Universitat Autònoma de Barcelona)

Session Classification: Poster session

Track Classification: Poster contributions

Contribution ID: **10** Type: **Talk**

Muon efficiency with the HESS telescope

Tuesday, 11 June 2013 11:00 (30 minutes)

The H.E.S.S. cameras require a precise and regular calibration over time, to reconstruct the gamma-ray characteristics. The different sub-systems used to determine the gain and the uniformity of the PMTs and their evolution with time are presented. Then, we focus on the absolute energy scale calibration, by using a full reconstruction of isolated muons recorded during normal observation, which is directly connected to atmospheric absorption. The method and the evolution of the absolute overall light collection efficiency are shown.

Primary author: CHALMÉ-CALVET, Raphaël (LPNHE)

Presenter: CHALMÉ-CALVET, Raphaël (LPNHE)

Session Classification: Tuesday morning 2

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **11** Type: **Talk**

Detailed studies of atmospheric calibration in imaging Cherenkov astronomy

Tuesday, 11 June 2013 09:30 (30 minutes)

The current generation of imaging atmospheric Cherenkov telescopes are allowing the sky to be probed with greater sensitivity than ever before in the energy range below and around 100 GeV. To minimize the systematic errors on derived fluxes a full calibration of the atmospheric properties is important given the calorimetric nature of the technique. In this talk we will recount an approach used to address this problem by using a ceilometer co-pointed with the H.E.S.S. telescopes and present the results of the application of this method to a set of observational data taken on the active galactic nucleus (AGN) PKS 2155-304 in 2004 and the standard candle of VHE gamma-ray astronomy the Crab Nebula.

Primary author: Dr NOLAN, Sam (Durham University)

Presenter: Dr NOLAN, Sam (Durham University)

Session Classification: Tuesday morning 1

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **12** Type: **Talk**

Recent interpretation and correlation of the HESS Lidar Data

Monday, 10 June 2013 14:15 (30 minutes)

We present an overview of a Elastic Lidar installed on the HESS site. Been in operation for the last 3 years, we will present the state of the analysis and correlation obtained in conjuction with the Hess central trigger data. Possible interpretaion and future plans will also be presented

Primary author: VASILEIADIS, George (LUPM)

Presenter: VASILEIADIS, George (LUPM)

Session Classification: Monday afternoon 1

Track Classification: Monitoring facilities in operation

Contribution ID: **13** Type: **Talk**

ARCADE – Atmospheric Research for Climate and Astroparticle Detection

Tuesday, 11 June 2013 16:45 (30 minutes)

The characterization of the optical properties of the atmosphere in the near UV, in particular the tropospheric aerosol stratification, clouds optical depth and distribution are common to the field of the physics of the atmosphere, due to aerosol effect on climate, and also to the physics of cosmic rays, for a correct reconstruction of energy and longitudinal development of showers.
The goal of the ARCADE-Project is the comparison of the aerosol attenuation measurements obtained with the typical techniques used in cosmic rays experiments (side-scattering measurement, elastic-LIDAR and Raman-LIDAR) in order to assess the systematics affecting each method providing simultaneous observations of the same air mass with different techniques. For this purpose we projected a LIDAR that is now under costruction: it will use a 355 nm Nd:YAG Laser and will collect the elastic and the N2 Raman back-scattered light. For the side-scattering measurement we will use the Atmospheric Monitoring Telescope, a facility owned by the Colorado School of Mines and placed in Lamar (Colorado), the site where our experiment will take place starting from 2013.

Primary author: BUSCEMI, Mario (Università di Napoli "Federico II", ITALY)

Co-authors: Dr TONACHINI, Aurelio Siro (Università degli Studi di Torino, ITALY); Prof. CASSARDO, Claudio (Università degli Studi di Torino, ITALY); Dr GUARINO, Fausto (Università di Napoli "Federico II", ITALY); Dr VALORE, Laura (Università di Napoli "Federico II", ITALY); Prof. WIENCKE, Lawrence (Colorado School of mines, USA); CILMO, Marco (Università di Napoli "Federico II", ITALY); COCO, Michael (Colorado School of Mines, USA); Dr FERRARESE, Silvia (Università degli Studi di Torino, ITALY)

Presenter: BUSCEMI, Mario (Università di Napoli "Federico II", ITALY)

Session Classification: Tuesday afternoon

Track Classification: Monitoring facilities under development

Contribution ID: **14** Type: **Talk**

Determining atmospheric aerosol content with an infra-red radiometer

Monday, 10 June 2013 14:45 (30 minutes)

The attenuation of atmospheric Cherenkov photons is dominated by two processes: Rayleigh scattering from the molecular component and Mie scattering from the aerosol component. Aerosols are expected to contribute up to 30 Wm^{-2} to the emission profile of the atmosphere, equivalent to a difference of ~20C to the clear sky brightness temperature under normal conditions. Here we investigate the aerosol contribution of the measured sky brightness temperature at the H.E.S.S. site; compare it to effective changes in the telescope trigger rates; and discuss how it can be used to provide an assessment of sky clarity that is unambiguously free of telescope systematics.

Primary author: Dr DANIEL, Michael (University of Liverpool)

Presenter: Dr DANIEL, Michael (University of Liverpool)

Session Classification: Monday afternoon 1

Track Classification: Monitoring facilities in operation

Contribution ID: **15** Type: **Talk**

Simulations of detector arrays and the impact of atmospheric parameters

Monday, 10 June 2013 16:15 (45 minutes)

In Monte-Carlo simulations of detector arrays on the ground (here mainly arrays of Cherenkov telescopes), the atmosphere enters in several ways: in the development of the particle showers, in the
emission of light by shower particles, and in the propagation of
Cherenkov light (or fluorescence light or of particles) down to
ground level. Relevant parameters and their typical impact on
energy scale etc. will be discussed.

Primary author: Dr BERNLÖHR, Konrad (MPIK Heidelberg)

Presenter: Dr BERNLÖHR, Konrad (MPIK Heidelberg)

Session Classification: Monday afternoon 2

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **16** Type: **Poster**

Global Atmospheric Models for Cosmic Ray Detectors

Tuesday, 11 June 2013 15:20 (5 minutes)

A good knowledge of atmospheric parameters is necessary for the reconstruction of air showers, especially with the fluorescence technique. The Global Data Assimilation System (GDAS) provides altitude-dependent profiles of temperature, pressure, humidity and several other state variables. Every three hours, a new data set is available for the entire globe. These GDAS data are now used in the standard air shower reconstruction for the Pierre Auger Observatory. The validity of the data was verified through comparisons with monthly models that were averaged from on-site meteorological radio soundings and weather station measurements obtained at the Observatory in Malargüe. Comparisons of reconstructions using the GDAS data and the monthly models are also presented. Since GDAS is a global model, the data can potentially be used for other cosmic and gamma ray detectors and several studies were already done or are underway for several locations worldwide.

Primary author: Dr WILL, Martin (Karlsruhe Institute of Technology)

Co-author: Dr KEILHAUER, Bianca (Karlsruhe Institute of Technology)

Presenter: Dr KEILHAUER, Bianca (Karlsruhe Institute of Technology)

Session Classification: Poster session

Track Classification: Poster contributions

Contribution ID: **17** Type: **Talk**

Nitrogen fluorescence in air for observing extensive air showers

Monday, 10 June 2013 17:00 (30 minutes)

Extensive air showers initiate the fluorescence emissions from nitrogen molecules in air. The UV-light is emitted isotropically and can be used for observing the longitudinal development of extensive air showers in the atmosphere over many kilometers. This measurement technique is well established since it has been used since many decades by several cosmic ray experiments. However, a fundamental aspect of the air shower analyses is the description of the fluorescence emission in dependence on varying atmospheric conditions. Different fluorescence yields affect directly the energy scaling of air shower reconstruction. Furthermore, while applying the fluorescence technique to air shower observations, the position of the shower maximum, a strong indicator for the type of the primary particle of the air shower, can be measured directly.
Within this contribution, the effects of the atmosphere-dependent fluorescence description and the level of accuracy of the underlying atmospheric data are discussed and demonstrated by showing full air shower reconstructions.

Primary author: Dr KEILHAUER, Bianca (Karlsruhe Institute of Technology)

Presenter: Dr KEILHAUER, Bianca (Karlsruhe Institute of Technology)

Session Classification: Monday afternoon 2

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **18** Type: **Talk**

Atmospheric considerations for CTA site search

Wednesday, 12 June 2013 11:10 (35 minutes)

The Cherenkov Telescope Array (CTA) will be the next high-energy gamma-ray observatory. Selection of the sites, one in each hemisphere, is not obvious since several factors have to be taken into account. Among them, and probably the most crucial, are the atmospheric conditions.
Since July 2012, the site working group has deployed automatic ground based instrumentation (ATMOSCOPE) on all the candidate sites. Due to the limited time span available from ground based data, long term weather forecast models become necessary tools for site characterization.It is then of prime importance to validate the model by comparing it to the ATMOSCOPE measurements.
We will describe the sources of data (ATMOSCOPE and weather forecasting model) for the site evaluation and how they will be used and combined.

Primary author: VINCENT, stephane (desy zeuthen)

Presenter: VINCENT, stephane (desy zeuthen)

Session Classification: Wednesday morning 2

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **19** Type: **Talk**

From the Utah desert to the international space station: The evolution of atmospheric monitoring for astroparticle physics detectors

Monday, 10 June 2013 09:45 (1 hour)

The earth's atmosphere offers an enormous detector for cosmic rays. Without it, high energy particles could not generate air showers accompanied by profiles of detectable light. But once the light is created, these photons encounter a dynamic time-dependent medium through which they must propagate to reach the detector focal surface(s). Unraveling this process is a critical puzzle of a rich interdisciplinary nature. This talk will review some of the successes, lessons and challenges of atmospheric monitoring for optical cosmic ray detectors of increasing aperture and complexity. Using examples from various projects including Fly's Eye, HiRes, and the Pierre Auger Observatory, this talk will focus on methods and strategies to determine atmospheric transmission and end to end photometric calibration including the atmosphere. The aim of this review is to benefit atmospheric monitoring programs for cosmic ray and gamma ray experiments that are in the planning and conceptual stages.

Primary author: WIENCKE, Lawrence (Colorado School of mines)

Presenter: WIENCKE, Lawrence (Colorado School of mines)

Session Classification: Special Seminar

Track Classification: Special Seminar

Contribution ID: **20** Type: **Poster**

Design of a 2-elastic plus 2-Raman lines optical module for a Raman lidar for CTA

Tuesday, 11 June 2013 15:05 (5 minutes)

CTA is an advanced facility for ground-based gamma-ray astronomy in the GeV-TeV regime, currently in the Preparatory Phase. For a correct reconstruction of gamma-ray energies and fluxes, a precise monitoring of the atmospheric transmission is needed. With this aim, the IFAE and UAB institutes are building a specific Raman lidar.
For the optical module, we have foreseen to read-out from the lidar return 2 elastic (355 and 532 nm) and two Raman (387, 607) lines. In this contribution, we will discuss the design of the optical module, the light beam transportation, the solution for the custom made dichroic mirrors, interference filters.

Primary author: DORO, Michele (University of Padova and INFN)

Co-authors: Dr OSCAR, Blanch (Institut de Fisica d'Altes Energies); Dr VANIA, Da Deppo (CNR-Institute for Photonics and Nanotechnologies UOS Padova LUXOR, Via Trasea 7, 35131 Padova, Italy); Prof. LLUIS, Font (Universitat Autonoma de Barcelona); Ms ALICIA, Lopez Oramas (Institut de Fisica d'Altes Energies); Prof. MARTINEZ, Manel (IFAE Barcelona); Dr GAUG, Markus (Universitat Autònoma de Barcelona)

Presenter: DORO, Michele (University of Padova and INFN)

Session Classification: Poster session

Track Classification: Poster contributions

Contribution ID: **21** Type: **Talk**

Atmospheric Monitoring for the MAGIC telescope

Monday, 10 June 2013 15:15 (30 minutes)

The MAGIC telescopes are a system of two dishes operating stereoscopically for ground-based gamma-ray astronomy at the TeV since 2004. The energy and flux reconstruction in this kind of experiment, is substantially affected by the atmospheric conditions, specially by the presence of aerosols and clouds. For atmospheric monitoring, MAGIC hosts different subsystems: a single-channel non-commercial elastic lidar with an HPD reading the 355~nm line, a pyrometer measuring the sky temperature, an all-sky camera, and two commercial weather stations.
In this contribution, an overview of these subsystems, as well as the global strategy for atmospheric monitoring of MAGIC, will be given.

Primary authors: Dr GAUG, Markus (Universitat Autònoma de Barcelona); DORO, Michele (University of Padova and INFN)

Co-authors: GARRIDO, Daniel (Universitat Autonoma de Barcelona); FONT, Lluis (Universitat Autonoma de Barcelona)

Presenter: Dr GAUG, Markus (Universitat Autònoma de Barcelona)

Session Classification: Monday afternoon 1

Track Classification: Monitoring facilities in operation

Contribution ID: **22** Type: **Talk**

Atmospheric Aerosol Attenuation Measurements at the Pierre Auger Observatory

Monday, 10 June 2013 11:10 (30 minutes)

The Fluorescence Detector (FD) of the Pierre Auger Observatory provides a nearly calorimetric measurement of the primary particle energy, since the fluorescence light produced is proportional to the energy dissipated by an Extensive Air Shower (EAS) in the atmosphere.
The atmosphere is therefore assimilable to a giant calorimeter, whose properties need to be well known during data taking. Aerosols play a key role in this scenario, since the light transmission through aerosols is highly variable even on a time scale of one hour, and the corresponding correction to EAS energy can range from a few percent to more than 40%. For this reason, hourly Vertical Aerosol Optical Depth (VAOD) profiles are provided for each of the four FD stations. Starting from 2004, up to now 9 years of VAOD profiles have been produced using data from the Central Laser Facility (CLF) and the eXtreme Laser Facility (XLF) of the Pierre Auger Observatory. The two laser facilities, the techniques developed to measure the VAOD profiles using laser data and the results will be discussed.

Primary author: Dr VALORE, Laura (Universita' di Napoli Federico II)

Presenter: Dr VALORE, Laura (Universita' di Napoli Federico II)

Session Classification: Monday morning

Track Classification: Monitoring facilities in operation

Contribution ID: **23** Type: **Poster**

FRAM - the optical telescope for atmospheric monitoring

Tuesday, 11 June 2013 15:15 (5 minutes)

FRAM (F/Photometric Robotic Atmospheric Monitor) is a small optical telescope located at the Pierre Auger Observatory equipped with two CCD cameras with Johnson-Bessel UBVRI filters. We will present its observation program - spanning from the measurements of wavelength dependence of extinction (Angstrom coefficient) using the Landolt fields of standard stars, through the rapid monitoring of trajectories of cosmic rays showers with anomalous longitudinal profiles, to observations of opportunity astronomical targets - optical transients of gamma ray bursts, variable stars, minor planets and comets.

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Presenter: Dr MANDAT, Dusan (Institute of Physics of Academy of Science of The Czech Republic)

Session Classification: Poster session

Track Classification: Poster contributions

Contribution ID: **24** Type: **Talk**

LIDAR'S TELESCOPE AUTO-ALIGNMENT SYSTEM FOR CTA

Tuesday, 11 June 2013 17:15 (30 minutes)

A multi-wavelength scanning Raman lidar is being developed at CEILAP (CITEDEF-CONICET) to monitor the spectral properties of the aerosol extinction in the future CTA Observatory. The reception system of the lidar uses six Newtonian telescopes, with a mirror diameter of 40 cm and a focal length of 1 m. Fused silica optical fibers fix the field of view of the telescopes to 1 mrad and send the collected light to a polychromator. As the system is being exposed to harsh environmental conditions (wind burst, temperature span, etc…) robustness of the individual telescopes and self-alignment have been considered as the highest priorities in the design. In the current setup cooperative wireless interactions between the controlling PC software and the lidar microcontrollers keep the line of sight of the telescopes parallel to the laser emission. This design assures the quality of the acquired data independently of the skills of the remote lidar operator. The self-alignment system as well as the lidar hardware and software modules are extensively presented in this work.

Key words: aerosols, lidar, Raman, CTA observatory.

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Session Classification: Tuesday afternoon

Track Classification: Monitoring facilities under development

Contribution ID: **25** Type: **Talk**

Data quality monitoring in the presence of aerosols and other adverse atmospheric conditions with H.E.S.S.

Tuesday, 11 June 2013 17:45 (30 minutes)

Cherenkov telescope experiments, such as H.E.S.S., have been very successful in the astronomical observation in the very-high-energy (VHE, E>100GeV) regime.
As an integral part of the detector, such experiments use the earth atmosphere as a calorimeter. For the calibration and energy determination, a standard model atmosphere is assumed. Deviations of the real atmosphere from the model may therefore lead to an energy misreconstruction of primary gamma-rays.
To guarantee a satisfactory data quality with respect to difficult atmospheric conditions, several atmospheric data quality criteria are implemented in the H.E.S.S. software. These quantities are sensitive to clouds and aerosols.
Here, the Cherenkov transparency coefficient will be presented. It is a new monitoring quantity that is able to measure long-term decreases in the atmospheric transparency. The Cherenkov transparency coefficient derives exclusively from Cherenkov data and is quite hardware-independent. Furthermore, its positive correlation with independent satellite measurements,performed by the Multi-angle Imaging SpectroRadiometer (MISR), will be presented.

Primary authors: Mr HAHN, Joachim (MPIK); Dr DE LOS REYES, Raquel (MPIK)

Co-authors: Dr BERNLOEHR, Konrad (MPIK); Dr KRUEGER, Paulus (North-West University, Potchefstroom, South-Africa)

Presenter: Mr HAHN, Joachim (MPIK)

Session Classification: Tuesday afternoon

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **26** Type: **Talk**

The site characterization for the Cherenkov Telescope Array using geostationary satellites

To select the optimal site for the location of the future Cherenkov Telescope Array project (CTA) for observation of very high energy gamma rays many different data sourced are being analyzed and exploited. In order to obtain the reliable estimate of long-term evolution of the cloud cover above the candidate sites, we have used also the data from geostationary satellites. We will present the methodology of data analysis for Meteosat and GOES satellites and the observed differences for these two data sets.

Primary author: Dr PROUZA, Michael (Institute of Physics - Prague)

Presenter: Dr PROUZA, Michael (Institute of Physics - Prague)

Track Classification: Aerosols and interdisciplinary studies

Contribution ID: **27** Type: **Talk**

The Global Light System (GLS) for JEM-EUSO

Wednesday, 12 June 2013 13:30 (35 minutes)

The Extreme Universe Space Observatory on board the Japanese Experiment Module (JEM-EUSO) on the International Space Station (ISS) aims at measuring the properties of Extreme Energy Cosmic-Rays (EECRs) by recording their Extensive Air Shower developments in Earth's atmosphere from space. In order to test the good operation of the JEM-EUSO telescope, a network of ground-based Xenon flashers and steerable UV lasers is being developed. This Global Light System (GLS) will generate benchmark optical signatures in the atmosphere with similar characteristics than the optical signals produced by EECR showers. Laser tracks and point flashes will be produced as the ISS passes over a GLS location within the field of view of the telescope. The event reconstruction and triggering efficiency of JEM-EUSO can then be tested against the specific properties of the laser shots and Xenon flashes. Currently, it is envisioned that 12 GLS stations will be deployed at selected locations around the World. A preliminary study shows that JEM-EUSO will fly over one of the 12 sites in a near-moonless night under clear condition every 2 days or so. The GLS concept and design will be presented, including the early development of the GLS prototype and the selection process for candidate sites.

Primary author: SARAZIN, Fred (Colorado School of Mines)

Presenter: SARAZIN, Fred (Colorado School of Mines)

Session Classification: Wednesday afternoon 1

Track Classification: Monitoring facilities under development

Contribution ID: **28** Type: **Talk**

Seasonal aerosol trends from satellite measurements over HESS

Tuesday, 11 June 2013 11:30 (30 minutes)

The present work presents monthly statistics of satellite aerosol measurements over the H.E.S.S. site analyzing their seasonal trends during the period 2000 – 2013. Basic changes in the aerosol load distribution mainly correspond to biomass burning transport. It is known that large retrieval uncertainties over land can be expected depending on variable land cover and complex topography affecting surface albedo as well as the presence of clouds. However published ground measurements show similar behavior reinforcing the important of these trends to determine the atmospheric transmission at the site and in similar places over the region.

Primary authors: Dr OTERO, Lidia (Lidar Division - CEILAP (CITEDEF-CONICET)); Dr RISTORI, Pablo (Lidar Division - CEILAP (CITEDEF-CONICET))

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Presenter: Dr RISTORI, Pablo (Lidar Division - CEILAP (CITEDEF-CONICET))

Session Classification: Tuesday morning 2

Track Classification: Aerosols and interdisciplinary studies

Contribution ID: **29** Type: **Poster**

Aerosol concentration measurements and analysis of air mass backward trajectories at the Pierre Auger Observatory

Tuesday, 11 June 2013 15:25 (5 minutes)

Aerosols play an important role in the attenuation of UV fluorescence light originated when cosmic rays cross the atmosphere, interacting with the atmospheric nitrogen molecules. This light is recorded by the fluorescence detector (FD) of the Pierre Auger Observatory (www.auger.org), composed of 27 telescopes distributed in 4 stations. In one of these stations, named Coihueco (35° 06' 52.9'' S, 69° 36' 02.7'' W, 1712 m a.s.l.), an Aerosolspectrometer and Dust Monitor Grimm 1.109 was installed to register aerosol mass concentrations in different size intervals, at surface level. In this work we analyze the aerosol concentrations measured with Grimm 1.109 at surface level and correlate them with air masses trajectories obtained from HYSPLIT (NOAA) model calculations.

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Presenter: Dr LOUEDEC, Karim (LPSC, CNRS/IN2P3)

Session Classification: Poster session

Track Classification: Poster contributions

Contribution ID: **30** Type: **Talk**

Atmospheric simulations for the Cherenkov Telescope Array (CTA)

Tuesday, 11 June 2013 10:00 (30 minutes)

The Cherenkov Telescope Array (CTA) will be the world's first observatory for detecting gamma-rays from astrophysical phenomena and is now in its prototyping phase with construction expected to begin in 2015/16. In this talk we will discuss the detailed simulation studies performed to assess the need for atmospheric monitoring and the methods by which correction for atmospheric variation may be achieved. This will include discussion of some lidar analysis methods with a view to determining a range resolved atmospheric transmission in order to determine an appropriate atmospheric model for use in simulations.

Primary author: Dr RULTEN, Cameron (Observatoire de Paris)

Co-author: Dr NOLAN, Sam (Durham University)

Presenter: Dr RULTEN, Cameron (Observatoire de Paris)

Session Classification: Tuesday morning 1

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **31** Type: **Talk**

Atmospheric monitoring of Telescope Array experiment

Monday, 10 June 2013 11:40 (30 minutes)

Atmospheric monitoring is very important for the observation of air showers by the airfluorescence technique.
In the Telescope Array (TA) experiment, the LIDAR (LIght Detection And Ranging) system and the CLF (Central Laser Facility) system are used for the measurement of atmospheric transparency. The LIDAR system is located southeast of TA site, and the CLF is located in the center of the TA site. The usefulness of the CLF and LIDAR systems are demonstrated by analyzing the time variation of atmospheric transparency with the systems. The two atmospheric monitor systems are complementary. We have installed a new LIDAR system at the CLF location, and we expect this will yield valuable data. Clouds are observed with a CCD camera and an IR camera and by visual checks. In addition, we have also measured atmospheric parameters at the ground level using several weather systems. In this talk, these detector systems will be described.

Primary author: Dr TOMIDA, Takayuki (RIKEN)

Presenter: Dr TOMIDA, Takayuki (RIKEN)

Session Classification: Monday morning

Track Classification: Monitoring facilities in operation

Contribution ID: **32** Type: **not specified**

AtmoHEAD Wrap-up

Wednesday, 12 June 2013 13:15 (15 minutes)

Presenter: Dr CHAVES, Ryan (CEA/SAp)

Contribution ID: **33** Type: **not specified**

Welcome to CEA/IRFU

Tuesday, 11 June 2013 09:15 (15 minutes)

Presenter: Dr STOLARCZYK, Thierry (CEA Irfu)

Contribution ID: **34** Type: **Talk**

Current capabilities for atmospheric monitoring

Tuesday, 11 June 2013 15:45 (1 hour)

This presentation will describe the various atmospheric monitoring techniques that may be of interest to the Atmohead community :
• Temperature (density) profile of the atmosphere, from the surface and by satellite
• Cloud cover and cloud parameters by satellite
• Aerosol extinction profile by ground-based Lidar
• Aerosol extinction profile by spaceborne Lidar
• Aerosol scattering properties
The author works in the climate / environment research field. The presentation and the subsequent discussion are intended to present what is currently available, but mostly to reach a better understanding of the Atmohead community needs, and identify potential collaborations between the communities.

Primary author: BREON, Francois-Marie Breon (CEA/LSCE)

Presenter: BREON, Francois-Marie Breon (CEA/LSCE)

Session Classification: Interdisciplinary keynote

Track Classification: Interdisciplinary keynote

Contribution ID: **35** Type: **Talk**

Atmospheric calibration and simulation of the cloud cover for the LSST survey

Wednesday, 12 June 2013 15:10 (35 minutes)

High-priority science goals of the LSST mission such as weak lensing and baryon acoustic oscillations require exquisite knowledge of the density and spatial distribution of galaxies. The atmosphere can introduce photometric errors correlated on spatial scales of tens of arc-minutes where much of the power in these analyses is to be found. The LSST science requirements include a design specification of 10 mmag (stretch goal 5mmag) on the rms variation of the photometric zero-point across the sky, but this has been strengthened to require that errors of this magnitude not be spatially correlated. Furthermore, LSST is designed to observe even during non-perfectly photometric nights, to maximise the observing time. The calibration process must thus be robust to a broad variety of atmospheric conditions, including those prevailing during nights traditionally classified by astronomers as non photometric. This implies extensive simulations based on atmosphere transmission spectra reproducing the complexity of the real atmosphere with all its constituents and their variations in space and time, in so far as they affect light transmission. This is why the preparation of the calibration pipeline and simulation of atmosphere are of primary importance to prepare this survey. Several points concerning the atmospheric transmission have thus to be adressed in the current simulations to ensure we can meet the LSST science requirements : wavelength dependent extinction (see A. Boucaud's presentation) and so called gray extinction. Water droplets and ice crystals in clouds are relatively large compared to the wavelength of visible and NIR light, so the extinction due to cloud is independent of the wavelength. Nevertheless, the changes in spatial direction and time for the cloud cover are expected to be quick and the use of LSST during non strictly photometric nights makes it essential to integrate the cloud cover properly in the simulation package to prepare the LSST calibration pipeline. We will present here the plans for atmospheric monitoring and calibration of the LSST and focus particularily on this last point concerning cirrus cover monitoring and simulation.

Primary author: Mrs ROUCELLE, Cécile (APC)

Presenter: Mrs ROUCELLE, Cécile (APC)

Session Classification: Wednesday afternoon 2

Track Classification: Simulations, modeling, and reconstruction

Contribution ID: **36** Type: **Talk**

Study and simulation of aerosols for the LSST photometric calibration

Wednesday, 12 June 2013 15:45 (35 minutes)

The LSST is a 8m wide-field photometric telescope that will run at Cerro Pachón in Chile, starting in 2020. As part of the calibration of the 6 large photometric bands ugrizy, there is a need to monitor the atmospheric transmittance in time and across the field of view (~10 deg2). An auxiliary telescope with a spectrometer will be dedicated to that task, fitting an atmospheric model to the spectra of reference stars in the course of the night. The current model is based on template fitting and assumes the atmospheric absorption spectrum in the visible can be decomposed into the physical contribution of its main constituents: Rayleigh scattering, molecular absorption from water vapor, ozone, oxygen and others, Mie diffusion from the aerosols and cloud extinction. In order to test the validity of that model, we have gathered data on these several constituents in the region and made an attempt to realistically simulate their long term variations. In this talk I will present specifically the study and simulation of aerosols.

Primary author: Mr BOUCAUD, Alexandre (APC, université Paris 7 diderot)

Presenter: Mr BOUCAUD, Alexandre (APC, université Paris 7 diderot)

Session Classification: Wednesday afternoon 2

Track Classification: Aerosols and interdisciplinary studies