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RESEARCH EXPERIENCE

My main interests are devoted to the very high energy (VHE, E > 50 GeV) astroparticle physics with Imaging Atmospheric Cherenkov Telescopes (IACTs). In particular, I am interested in VHE gamma-ray emission mechanisms from distant AGNs and in studies of cosmology and fundamental physics, which become accessible through the measurements of energy spectra of these AGNs at VHE gamma-rays. I am convinced that at the ICRR, Tokyo, I will get the best opportunities to further shape this still young research field and make an essential contribution to its success.

I have a strong physics and astrophysics background, which I acquired during the 5 year studies at the University of Hamburg, 1 year at the Southampton University, England, 3 years PhD at MPI, Munich, and finally 5 years as Marie Curie fellow and Otto Hahn group leader at IFAE, Barcelona and MPI for physics, Munich. It was in Hamburg, in 2002, during the time of my diploma thesis, where I made my first contacts with the field of gamma-ray astrophysics. Both the relatively young research field and the measuring technique using IACTs fascinated me. In 2003 I became a member of the MAGIC collaboration. In the following years I made significant contributions to the physics exploration of the field and to construction, commissioning and successful operation of the stereoscopic system of the two MAGIC telescopes. In years 2009-2012 I led the major upgrade of the MAGIC telescopes, which was successfully finished in October 2012. In the following, I will first describe my scientific interests and achievements, then my software and hardware expertise and finally my management experience.

My early interest in the extreme universe, i.e. the universe at extreme energies, triggered my studies on AGNs, the relativistic processes that take place in their jets, the emission mechanisms of non-thermal radiation at highest energies as well as interaction of the emitted radiation with the so-called soft photon fields. Later, I focused on the study of the propagation of the gamma-ray radiation from AGNs through space and its interaction with the diffuse field of the extragalactic background light (EBL). My studies of the EBL were instrumental to set strong upper limits on the EBL density, suggesting that there is no significant contributing to the EBL from unresolved sources or exotic components. I also developed a statistically robust method to determine the redshift of blazars using their TeV spectra, which is now commonly used in the field. My research on EBL made me to one of the world best known experts on this topic.

As a member of the MAGIC collaboration my interests have been more diverse. Focused first on physics of extragalactic objects, I was the Principal Investigator of discovery of three new blazars with MAGIC: Mkn180, 1ES1011+496 and S50716+714, as well as the first study of the well-known blazar Mkn421 with MAGIC. I also led the interpretation of the energy spectra from 3C 279 (z=0.536) measured by MAGIC in terms of implication of such measurement for the EBL density and history of the universe. This MAGIC measurement was the first indirect probe of the UV light escaping the early galaxies and was confirmed 5 years later by the Fermi/LAT measurements. Since 7 years I am leading efforts on multiwavelength campaigns triggered by VHE gamma-ray activity of AGNs and in particular I am coordinating the joint alert system of the 3 big collaborations H.E.S.S., MAGIC and VERITAS. Joint campaigns led to discovery of short variability of the gamma-ray flux from the giant radio galaxy M87 (time scales of less than 1 day) and a strong hint that the gamma-rays are produced in a direct vicinity of the super massive black hole. Moreover, I am the Principal Investigator of short time variability of the Crab Nebula flux at VHE gamma-rays. Long before such variability was discovered by Fermi/LAT at around 1 GeV energies, there were strong hints that the Crab Nebula (which is the standard candle of gamma-ray astrophysics) flux is not stable on ~10% level at energies above 200 GeV. Because such flux variation would be much below the systematics of the experiment, an extensive investigations took place over several years and it is still an ongoing effort.
I am involved in the CTA project since the very beginning. Within CTA, I mainly work on the science perspectives of the project focusing on EBL studies and cosmology, targeting the rich scientific potential of the planned observatory. As a convener of the EBL and cosmology group in CTA I coordinate the work of around 20 scientists around the world. The work resulted in several articles in refereed journals and made EBL/cosmology cosmology case to one of the major drivers to ensure that CTA has a low energy threshold of 20 GeV or less.

My software expertise is based on 10+ years experience of data analysis, code writing and debugging for Imaging Cherenkov Telescopes. I first worked on data calibration, software development and data analysis. I wrote my own analysis chain based on the so-called model analysis, in which the gamma-hadron separation is based on a maximum likelihood fit of the images obtained with Cherenkov telescopes with the library of template images for gamma-rays. I also worked on data - Monte Carlo comparison of first data taken with MAGIC, debugging the standard analysis software and tuning parameters for the Monte Carlo production. I produced first software to generate gamma-ray images of sources detected with MAGIC (sky plots). I am also an expert on the unfolding techniques of the gamma-ray spectra obtained (unfolding of energy spectra is very important to correct for threshold effects and non-ideal response functions of the instrument) and the reference person in MAGIC in case there are questions or problems in applying these techniques to data. Within CTA, I work on the interface between the Monte-Carlo and the physics working groups. I developed analysis tools to simulate spectra and light curves for user specified astronomical phenomena and folding them

with the expected CTA response functions. The tools became a standard for the physics group to perform feasibility and requirement studies, which are one of the most critical inputs when deciding at which site CTA will be built.

My hardware expertise includes almost all aspects of IACTs but mainly the camera, the readout and the trigger of MAGIC. In 2007 I was closely involved in the development, production and quality control of the optical receiver boards for the MAGIC-II telescope at IFAE, Spain. In the years 2008-2009 I led the commissioning of the readout system (consisting of the receiver boards, DRS2 digitizer and a data acquisition system) of the MAGIC-II telescope in La Palma. Since that time, I am also responsible for the slow control and monitoring of the trigger, readout electronics and the calibration system of MAGIC. In the last 10 years I spent more than 2 years in total at La Palma working on the improving of the MAGIC telescopes. In the years 2011-2012 I commissioned the MAGIC telescopes in different hardware configurations from scratch twice. I became the reference person for the trigger and the readout system as well as for the operation and maintaining of the telescope system.
Since 2010 I am working on new photosensors and their usage in Cherenkov telescopes. I built and supervise test stands in two labs (IFAE, Barcelona and MPI, Munich) to characterize SiPMs and compare them with conventional photomultipliers. The goal is to build modular SiPM clusters compatible with the MAGIC PMT clusters and perform field tests in La Palma using the MAGIC camera. If successful, SiPM cameras can be built for large size telescopes such as MAGIC or CTA LSTs.

Since Autumn 2009 I serve as as MAGIC upgrade manager, which makes me responsible for the coordination, installation and commissioning of a new MAGIC-I telescope camera, a new trigger and readout system based on the DRS4 chip for the two MAGIC telescopes. In the preparation phase I coordinated multinational teams in Spain, Italy and Germany which were responsible to build and test individual components for the MAGIC upgrade. In 2011/2012, I spent altogether 9 months in La Palma leading a large team of students, post-docs and engineers to install the new readout electronics, the camera and the trigger and then to commission the telescope system. The upgrade finished successfully in October 2012 with the installation of the new camera and improving safety of the MAGIC telescope structure. The telescopes are fully operational and the performance is as planned or better. At the moment I am coordinating the efforts to fine-tune the telescope system in order to achieve a stable operation and the best performance in the next years.

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