1. FINAL PUBLISHABLE SUMMARY REPORT

During the time of the Marie Curie project, the participant was actively involved in two experiments: MAGIC and CTA.
The MAGIC collaboration, a joint effort of 150 European physicists, built in 2002 the largest ground-based gamma-ray telescope in the world: the 17-m diameter MAGIC-I telescope in the Spanish island of La Palma off the African Coast. Having set out to study the nature and the mechanisms of particle acceleration and production in galactic and extragalactic astronomical objects, MAGIC-I has already made seminal discoveries. In 2009, a second giant telescope of essentially the same characteristics was added; MAGIC-II was installed at a distance of 85 meters from MAGIC-I. Running together in the so-called stereo mode, the two telescopes can detect a twice-fainter gamma-ray source in the same observational time compared to sources, which can be detected with the original MAGIC-I. The accessible energy range of the MAGIC stereo system extends from 25 GeV to tens of TeV, i.e. the energy range, which on one hand reaches the highest energy gamma-rays detected so far and, on the other hand, is well overlapping with NASA´s space-borne Fermi Gamma-Ray Space Telescope (FGST), launched in mid-2008. The participant took an essential part in construction and commissioning of the second MAGIC telescope as well as in taking, analyzing and publishing MAGIC data. In particular, the achievements of the participant within MAGIC are:

1. The participant took a leading role in the commissioning of the second MAGIC telescope. He participated in the installation of the subsystems of the telescope. In particular he was (is) deeply involved in the development, installation, and commissioning of the telescope's readout system. Apart from a continuous remote help from the host institute, he spent 16 weeks in La Palma (5 visits in total in the two years) at the telescope site working on the commissioning of the subsystems, first successful data taking with the system of the two MAGIC telescopes as well as installation, tuning and characterization of the stereo trigger system.
2. The participant is a principal investigator of two MAGIC observation proposals for the cycle IV (covering June 2008 – June 2009), a principal investigator of three observation MAGIC proposals for the cycle V (July 2009 – June 2010), and a principal investigator of one observation MAGIC proposal for the cycle VI (July 2010 – June 2011). The proposals were granted the requested observation time by the Time Allocation Committee and already lead to a discovery of two gamma-ray TeV sources: S5 0716+714 with a redshift of z=0.26, the second distant source discovered by Cherenkov telescopes so far; and a TeV gamma-ray source in the vicinity of 3C66B, a signal which is probably associated with a radio galaxy 3C66B (z=0.021). Both discoveries are published in refereed journals with the participant being the corresponding author. The observations in Cycle V will lead to the MAGIC performance paper, which will be used as a MAGIC reference paper in the coming years. As well, the acquired data already led to discovery of 3 new extragalactic sources, in the energy range between 50 and 150 GeV where only few sources were detected so far, in the last 9 months underlying the improved performance of the MAGIC telescopes.
3. The participant organized two multiwavelength campaigns during the flaring episodes in the radio galaxy M87 (in 2008 and 2010). The findings of the first campaign deserved two publications: one with a sub-sample of MAGIC data only and another one as a Science magazine letter with the joint multiwavelength data. The participant is the corresponding author of both publications. The findings of the second campaign are not less spectacular

and are currently being prepared for a joint publication in a prestigious peer reviewed journal.

4. Based on results of the campaigns organized by the participant and under his active participation in the data analysis, physics interpretation and writing the article, 12 refereed articles have been published in refereed journals during the 24 months of the Marie Curie grant.
5. The participant obtained a high political and managing responsibilities in the MAGIC Collaboration: he was the **chair of the MAGIC Speakers' Bureau** (2009-2010), he is currently **MAGIC upgrade manager** (managing the upgrade of the MAGIC-I camera and the upgrade of the readout of the two telescopes to take place in Summer 2011), member of **MAGIC Executive Board** (highest governing committee of the MAGIC Collaboration), a member of the MAGIC **Time Allocation Committee**, and a member of the **MAGIC Technical Board**.
6. The participant co-supervised a PhD thesis of Mr. Manel Errando (completed Summer 2009) and is supervising a PhD thesis of Mr. Gianluca Giavitto (to be completed in 2012).

The second experiment, the participant is involved in, is the next generation project called Cherenkov Telescope Array (CTA) envisioning to build an array of 40-60 Cherenkov telescopes of three different sizes to cover an energy regime from 20 GeV up to 200 TeV. The project is in a planning phase and was identified by the European Union as one of the most important large installations for the next 10-15 years. The participant takes an active role in the physics working group of CTA, currently leading the EBL (extragalactic background light) and cosmology working subgroup. The goal of the subgroup is to contribute to the design study of CTA and in particular to identify the physics potential of various detector configurations. Moreover, the participant prepared analysis tools for the general use of the CTA physics group connecting the needs of the physics group and the deliverables of the Monte Carlo working group.

Apart from the active work inside MAGIC and CTA collaborations, the participant continued deep study of the extragalactic background light (EBL) using available very high energy data. His work led to:

1. The constraints on the extragalactic background light (EBL) using gamma-ray spectra of extragalactic sources were derived for the most distant source detected so far at energies above 100 GeV: the quasar 3C 279. The participant led the interpretation section of this Science magazine article. The limits from 3C 279 were later revised by the participant taking into account a realistic internal radiation fields in the source, which could potentially lead to an internal absorption of very high energy gamma-ray radiation. On the other hand, the EBL limits derived in using all available gamma-ray spectra of extragalactic sources led to a publication of a generic EBL model, which takes advantages of the latest constraints providing a very close to reality prediction for the level and shape of EBL up to redshift of z=0.5.
2. A first attempt to constrain the EBL evolution (in the redshift) resulted in a detailed study of properties of the first stars in the universe, the so-called Population III stars. In detail, current EBL limits allowed to put first indirect constraints on the physics parameters of these stars, i.e. their initial mass function, evolution scenario and the localization of the time when their formation rate reached a maximum.
3. A deep study of potential EBL constraints using next generation Cherenkov telescope such as CTA focussing on the ultraviolet through mid-infrared range of the EBL.