The Quiescent Sun in Gamma Rays

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The present Fermi Large Area Telescope is offering an unprecedented opportunity to study the quiescent solar emission in gamma rays and its relation with solar conditions and cosmic rays. The Sun is a known quiescent gamma-ray source. Its gamma-ray steady state is unique for its spatially distinct components and is characterized by two distinct emissions: 1) disk emission due by pion decay of cosmic rays (CR) hadrons interacting with the solar atmosphere; 2) spatially extended emission from inverse Compton (IC) scattering of CR electrons and positrons (hereafter electrons) on the photons of the heliosphere. The CRs involved are the Galactic ones coming from outside the solar system. These CRs are affected by modulation due to the solar wind and magnetic fields, which partially prevent CRs, mostly at the lowest energies, to go closer to the Sun. For this reason, the flux of both gamma-ray components is expected to change over the solar cycle due to the modulation of the CRs in the heliosphere, and is expected to be anti-correlated with the solar activity. Observations of the gamma-ray emission from the disk provide information on CR proton interactions on the solar surface environment and its solar magnetic fields, and about possible new physics. Observations of the spatially extended IC emission provide information on CR electron spectra throughout the entire heliosphere, thus allowing comprehensive studies of the solar modulation of CRs in this region, and of the role of magnetic field on electron CR transport.

The student will participate in the international effort of analyzing and interpreting NASA Fermi Large Area Telescope gamma-ray data in order to gain information on the leptonic and hadronic cosmic rays and their interactions. Results will probe CRs and their modulation in the heliosphere for the various solar activity conditions, and it will probe the environment close to the Sun. Outcomes will provide also original insights into the transport of energetic particle of opposite signs in the inner heliosphere.
The student will have the opportunity to experience working in a large international collaboration.

We are looking for a candidate who is confortable working in a team and independently, driven by self-initiative and with a strong interest in the physical processes that generate gamma rays, and in how to develop codes and software for the analysis.
The ideal student has background in astrophysics or particle physics, and has programming knowledge. We expect the student to publish in scientific peer-reviewed journals.
Excellent knowledge of English is required.

All qualified and interested candidates of any nationality, gender, religion, are encouraged to contact Elena Orlando (eorlando@units.it).