Areas of Interest

COMPUTATIONAL RESOURCES FOR STATISTICAL DATA ANALYSIS AND NUMERICAL SIMULATIONS IN ASTROBIOLOGY

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Resources

- the Institute of Space Science is involved in GRID activities related to CERN experiments since 2001.
- the Institute's contribution to the ALICE collaboration: more than 400 cores computing power and over 200 TB storage capacities.
- over the last years the Institute's GRID infrastructure has provided computational resources to international collaborations such as Cluster, Venus Express, Planck, Euclid, Auger and JEM-EUSO.

Ongoing Projects

GROUND-BASED CALIBRATION OF ORBITAL UV TELESCOPES

- design a ground-based calibration system for orbital UV telescopes such as Mini-EUSO, JEM-EUSO and TUS.
- numerical simulations have been performed using GBSatCal (Ground-Based Satellite Calibration), a custom developed software package, that allows us to consider different types of:
  - radiation sources (lasers, Xe-flashers, high-power UV LEDs),
  - focal surface detector geometries and atmospheric models (US Standard Atmosphere 1976 and NRLMSISE-00), as well as to determine the optimal calibration geometry.

THE KEPRÓ PROJECT

- develop an innovative ultra-high precision experimental model of a modified scanning Kelvin Probe capable of rapidly mapping under full control the surface potential of samples with surface areas of the order of 50 x 50 mm² with a precision of better than 0.05 mV rms per point.
- the instrument is ideally suited for materials science, the semiconductor electronics industry as well as for biological and biomaterials medical applications (the study and monitoring of skin wounds, skin transplants, tendon damage regeneration).

Expertise

- Advanced statistical data analysis for high energy physics and astrophysics experiments (ALICE @ CERN, VERITAS, AUGER, JEM-EUSO).
- Numerical simulations using Monte Carlo methods employing software applications such as CORSIKA, GEANT4, FLUKA.
- Embedded systems
- Ray tracing based optical design.
- Database design and maintenance.
- Web technologies.
- Advanced programming languages (VDL, VHDL, IDL, C/C++, Perl, Python, Fortran, HTML, CSS, JAVA) used on Linux/UNIX, Microsoft OSs.

Areas of Interest

- The Habitability of Planets, Exoplanets & Moons
  - The local environment: atmosphere, surface, subsurface, magnetic field
  - Biosignatures
  - The external environment: radiation of "solar" and galactic origin, magnetic fields, type of orbit, distance to the parent star

Research data management:
- storage, access, sharing, synthesis

Hardware development for detection of habitability and biosignatures