UAM & IFT

IFT & IAA: 1. - Dark energy with BOSS. The Instituto de Física Teórica in Madrid offers undergraduate physics students the opportunity to enjoy research in the field of Cosmology. The student will have the unique opportunity to participate and benefit from ongoing research projects that focus on understanding the nature of the mysterious dark energy. The student will have access to the latest data from the BOSS Galaxy Redshift Survey, the largest spectroscopic survey so far. The main goal of the project is a detailed comparison of BOSS data with cosmological simulations of the large-scale structure of the universe, in order to constrain the size of the horizon at the matter-radiation equality; a key scale of the Big Bang cosmology that is directly related to the energy-matter content of the universe. The student will also benefit from discussions with other students and scientists at the institute working in a wide range of topics in theoretical physics.

IFT & IAA & EPS:

2. - Desarrollo de la electrónica y control de los motores de BigBOSS. Tareas de hardware: Lectura de sensores de monitorización térmica. Diseño del nuevo PCB que se ajuste a la mecánica del robot. Diseño y ejecución de pruebas del nuevo prototipo unitario. Estudio del sistema de prueba para el grupo de 19 posicionadores. Adaptación al sistema de posicionamiento que se está diseñando en Suiza por el FPL. Diseño de un conversor USB-I2C para facilitar las pruebas del equipo desde el PC.

Modificaciones del software de control del PC: Adaptación para la lectura de la temperatura. Adaptación al sistema de pruebas del equipo de Berkeley. Adaptación al sistema de posicionamiento del FPL. Mejoras.

Modificaciones del firmware: Optimización para la reducción del consumo de potencia. Adaptación al protocolo de comunicaciones I2C.

UAM : Cosmology - the study of the formation and ultimate fate of structures and galaxies throughout the Universe - is without a doubt one of the dominant fields of astrophysics today .

And in the last years theoretical and observational studies have begun to converge as we entered the so-called era of ”Precision Cosmology”. A picture has emerged in which contemporary structures have evolved by gravitational amplification of seed inhomogeneities that are likely of quantum origin. This picture ties together measurements of the cosmic background radiation, supernovae explosions in far distant galaxies, estimates of the primordial abundances of the light elements, measurements of the clustering of galaxies and, to a more limited extent, the characteristic properties of individual galaxies.

Computational Cosmology now is the modeling of structure formation in the Universe by means of numerical simulations. These simulations can be considered as the only “experiment” to verify theories of the origin and evolution of the Universe. Over the last 30 years great progress has been made in the development of computer codes that model the evolution of dark matter (as well as gas physics) on cosmic scales and new research discipline has established itself. And any interpretation of the high-quality observational data that emerged during the past decade (SDSS, WMAP, etc.) and will become available in the very near future (Pan-STARRS, PAndAS, DES, PAU, BigBOSS, GAIA, etc.) depends heavily on such theoretical modeling.

I am offering to introduce interested students (during the month of July 2013) into this exciting field acquainting them with state-of-the-art software for this task. The hands-on sessions where the students have to run their on cosmological simulations on high-performance computers will be accompanied by lectures introducing the basic physical and technical concepts.

IFCA

Combination of experimental data on Dark Matter and Higgs Searches

We are investigating Dark Matter (DM) from the theoretical side. In particular, we work in the framework of the Minimal Supersymmetric Standard Model (MSSM) that predicts a natural DM candidate, the lightest neutralino.
Several computer codes for the prediction of DM properties in the MSSM exist. Complementary, other codes are available that connect the scale of Grand Unification with our world, the electroweak scale, or codes that predict the properties of other sectors of the model, in particular the sector of the Higgs particles.
An important question is a combination of all predictions to confront the model with all experimental restrictions (from direct and indirect DM searches, Higgs searches at the Large Hadron Collider (LHC) at CERN, searches for Supersymmetric particles at the LHC etc.) The

project consists in combining two or three of the relevant computer codes and to test this combination with existing experimental data.
During this work an overview about various aspect of elementary particle physics and DM (within the framework of Supersymmetry) is given.
The project is suitable for one or two students.

UPV

The group of Universitat Politècnica de València offers to host two students in the "MultiDark" Summer Student Program. One of the students will be involved in activities related to the COUPP direct detection dark matter experiment, and particularly in the study of the generation, propagation and detection of acoustic signals in bubble chambers. He will do some measurements and analyses in the acoustic test chamber and compared them with simulations. The second student will be involved in activities related to the ANTARES/KM3NeT project. The student will be introduced to underwater neutrino telescopes and will do basic ANTARES data analysis. Students of physics or engineering degrees with capabilities in acoustics, instrumentation and/or signal processing and analysis techniques are candidates with the right profile.

IFIC-AHEP

The IFIC-AHEP group at Valencia accepts summer students for training in the group's research activities. Such activities are focused on phenomenology of beyond the Standard Model, Dark Matter and Neutrino physics. The selected students would get experience on direct and indirect dark matter searches, characterization of well--motivated dark matter candidates and their connection with neutrino physics.

UCM-Th

UCM-Th group offers to incorporate two students. Research topics proposed:

1. - Alternative cosmological models

The project focuses in the so called modified gravity theories and their possible connection to the dark matter and dark energy problems. In particular, we consider the possibility of studying dark energy models responsible for the present phase of accelerated expansion of the universe based on vector-tensor theories and other modifications of gravity such as f(R) gravity. Dark energy models which differ from the standard cosmological constant could have important implications in the determination of the cosmological parameters, and in particular in the present value of the dark matter abundance.

2. - Dark Matter Phenomenology

The identity of the nature of dark matter is a major question in both particle physics and astrophysics. The traditional particle candidates are cold and collisionless, and they predict missing energy and momentum signals at particle colliders. However, recent progress has expanded the list of well-motivated candidates and their possible signatures. In this project, we will study the basic properties of non-standard candidates, their motivation, their expected production mechanisms, and their implications for particle colliders, direct detection, indirect searches, and other astrophysical observations as possible modifications of the cosmic microwave background or primordial abundances.

UZ

In the frame of the Summer Students Program of the MULTIDARK project, the Zaragoza University group offer the incorporation of one student to the activities carried out at the LSC in the direct search of the galactic dark matter using different detection techniques. ANAIS uses NaI(Tl) scintillators and searches for the annual modulation expected in the dark matter signal. ROSEBUD works in R+D about a novel technique: scintillating bolometers, able to discriminate

the dark matter signals from the dominant backgrounds (beta and gamma particles).

The selected student will collaborate in the operation and maintenance of the detectors at the Canfranc Underground Laboratory. However, most of his work will be carried out at the Zaragoza University facilities.

IFAE y UCM-GAE

The MultiDark groups at Instituto de Física de Altas Energies (IFAE) in Barcelona and Grupo de Física de Altas Energías de la Universidad Complutense de Madrid (UCM-GAE) are offering to host a student in each group to work in the MAGIC gamma-ray telescopes at the Observatorio de El Roque de Los Muchachos on the island of La Palma. The stay of each student will be divided into two parts: one or two weeks at the host group (IFAE or UCM-GAE), during which the student will get familiar with the concepts of gamma-ray astronomy and with the way the MAGIC telescopes work, and a 2-week period at the observatory, in which the student will join the team which operates the telescopes. The full stay will take place during the months of June and/or July.

IFIC-Exp

IFIC’s group offers the summer students to get acquainted with the ANTARES and KM3NeT neutrino telescopes. There will be a variety of activities. They will learn to use at a basic level the data analysis tools with simple, but pedagogical problems using the ROOT package. They will make small simulations on concrete aspects of some problems related to ANTARES. They will prepare, guided by the group members, presentations on topics linked to dark matter and they will be encouraged to understand the essentials of the analyses being performed by some of the members of the research group. Finally, they will attend to the remote control of the ANTARES detector from the dedicated room installed at IFIC.