

# International Relativistic Astrophysics Ph.D. Program

# IRAP Ph.D.

The coordinated effort of many international organizations such as the National Aeronautics and Space Administration (NASA), the European Center for Nuclear Research (CERN), the European Southern Observatory (ESO), has led to an unprecedented amount of scientific information from the microphysical world all the way to the entire Universe. To harvest the results of these scientific missions, a specific Ph. D. program has been envisaged in order to involve the students in the analysis and modeling of the above observational data within the theory of general relativity and relativistic quantum and classical field theories. The students will also be involved in innovative experimental programs in relativistic astrophysics. The program provides expertise in the most advanced topics of experimental, mathematical and theoretical physics relevant to the context of astronomy, astrophysics and cosmology. These activities, being necessarily international, the scientific and academic institutions, indicated below, participate with their own specific scientific specialties and a joint degree is delivered, at the end of the program.

A deadline of 16<sup>th</sup> February 2014 has been established for the nine positions sponsored by the Erasmus Mundus Program. Five additional positions sponsored by CAPES, for students from Brazil, and two by FAPERJ for students from the state of Rio de Janeiro, have deadline 30<sup>th</sup> June 2014. Five additional positions open internationally and directly sponsored by the participating institutions will have deadline 30<sup>th</sup> September 2014. For the application and more information see <http://www.icranet.org/irap-phd>.

**COURSES:** DURING THE THREE YEARS 180 HOURS OF CLASSES WILL BE FOLLOWED, FROM THE COURSES INDICATED HERE, AS WELL AS FROM ADDITIONAL COURSES IN THE PARTICIPATING INSTITUTIONS.

## ICRANet

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**COSMOLOGY WITH GAMMA RAY BURSTS**  
Lorenzo AMATI (INAF-IASF Bologna)  
Carlo Luciano BIANCO (SAPIENZA-Rome and ICRANet)  
Michel BOER (UNICE-France)  
Pascal CHARDONNET (University of Savoie and ICRANet)

**HIGH ENERGY PHENOMENA IN ASTROPHYSICS**  
Felix AHARONIAN (DIAS-Dublin and MPIK-Heidelberg)  
João BRAGA (INPE Brazil)  
Marco TAVANI (INAF-IASF Rome)

**COSMOLOGICAL SINGULARITY,  
BKL COSMOLOGY AND HIDDEN SYMMETRIES IN GRAVITY**  
Vladimir BELINSKI (SAPIENZA-Rome and ICRANet)  
Hermann NICOLAI (MPIG-Einstein Institut)

**FEYNMAN DIAGRAMS IN RELATIVISTIC QUANTUM FIELD THEORIES**  
Giovanni AMELINO-CAMELIA (SAPIENZA-Rome)  
Johannes BLUEMLEIN (DESY and FU Berlin)  
Hagen KLEINERT (FU Berlin and ICRANet)

**ACCRETION ON BLACK HOLES**  
Sandip CHAKRABARTI (Bose Centre-Kolkata)  
Lev TITARCHUK (University of Ferrara)

**GENERAL RELATIVITY**  
Donato BINI (CNR and ICRANet)  
Kjell ROSQUIST (Stockholm University)  
Thibault DAMOUR (IHES and ICRANet)

**SUPERNOVAE AND GAMMA RAY BURSTS**  
David ARNETT, Xiaohui FAN (UA at Tucson)  
Massimo DELLA VALLE (INAF-Naples and ICRANet)  
Luca IZZO and Remo RUFFINI (SAPIENZA-Rome and ICRANet)

**SPACE AND GROUND-BASED TESTS OF GENERAL RELATIVITY**  
Francis EVERITT and Paul WORDEN (Stanford University)  
Claus LAEMMERZAHN and Volker PERLICK (University of Bremen)  
Costantino SIGISMONDI (ON Rio and ICRANet)

**LARGE SCALE STRUCTURE AND DARK MATTER**  
Jaan EINASTO (Tartu Observatory and ICRANet)  
Martin MAKLER (CBPF and ICRANet)  
Piero ROSATI (University of Ferrara)  
Shufang SU (UA at Tucson)

**X/GAMMA-RAY INSTRUMENTATION**  
João BRAGA (INPE)  
Filippo FRONTERA (University of Ferrara)

**MULTIWAVELENGTH AND TIME-DOMAIN DATA ANALYSIS IN ASTROPHYSICS**  
Bernardo FRAGA (ICRANet)  
Paolo GIOMMI (ASI)  
Mauro ORLANDINI (University of Ferrara)  
Shuangnan ZHANG (IHEP - Chinese Academy of Science)

**ON BLACK HOLES**  
Roy KERR (ICRANet)

**BOUNCING COSMOLOGY**  
Mario NOVELLO and Nelson PINTO-NETO (CBPF and ICRANet)

**GAMMA RAY BURST THEORIES AND OBSERVATIONS**  
Luca IZZO and Marco MUCCINO (SAPIENZA-Rome and ICRANet)  
Tsvi PIRAN (Hebrew University of Jerusalem)  
Felix RYDE (Stockholm University)  
Bing ZHANG (University of Nevada Las Vegas)

**WHITE DWARFS, NEUTRONS STARS, BOSON STARS: OBSERVATIONS AND THEORY**  
Riccardo BELVEDERE and Sheyse M. de CARVALHO (ICRANet)  
Sergio FRASCA (SAPIENZA-Rome) and Jutta KUNZ (University of Oldenburg)  
Manuel MALHEIRO (ITA Brazil)  
Jorge RUEDA (SAPIENZA-Rome and ICRANet)

**RELATIVISTIC KINETIC THEORY,  
STRONG COUPLING QED AND ELECTRON-POSITRON PLASMA**  
Antonino DI PIAZZA and Christoph H. KEITEL (MPIK)  
Gregory VERESHCHAGIN and She-Sheng XUE (SAPIENZA-Rome and ICRANet)

