The field of relativistic astrophysics has become one of the fastest progressing fields of scientific development. This is due to the fortunate interaction of a vast number of international observational and experimental facilities in space, on the ground, underground, in the polar ice caps, and in the deep ocean, supported by a powerful theoretical framework based on Einstein’s theory of general relativity and relativistic quantum field theory. In 1995, the International Center for Relativistic Astrophysics in Rome (ICRA) initiated an International Network of Centers in the field of Relativistic Astrophysics (ICRANet) which has this year acquired the status of International Organization. The ICRANet combines the research powers of leading institutions in the Americas, Australia, Asia and Europe. The coordinating center is located in the town of Pescara, Italy. In parallel with these activities, the International Relativistic Astrophysics Ph.D. Program (IRAP PhD) has been created with the goal of training a highly qualified number of Ph.D. students in this exciting field of research. So far, the participating institutions are: ETH Zürich, Freie Universität Berlin, Observatoire de la Côte d’Azur, Université de Nice-Sophia Antipolis, Università di Roma "La Sapienza", Université de Savoie. The IRAP-PhD is granted by all these institutions. Each program cycle lasts three years. The courses and related scientific activities cover a broad range of scientific topics including the mathematical and geometrical structure of spacetime, relativistic field theories of fundamental interactions both at the classical and quantum levels, astronomical and astrophysical observational techniques, and the associated phenomenological and theoretical descriptions. The research style is by its own nature interdisciplinary and international. The students will take courses at all participating institutions.

This is the announcement of the fourth IRAP PhD cycle. The year 2005 signals the one hundredth anniversary of the “annus mirabilis” in which Einstein revolutionized the field of physics. In addition to the courses and research on relativistic field theory, black holes and cosmology the Graduate school will co-organize:

four “lecciones magistrales” in Nice in October 2005 by Remo Ruffini, Nathalie Deruelle, Yuval Vitagliano, Dr. She-Sheng Xue.


“The reference frame” An International meeting, February 2006 in Nice;

XI Michel Grossmann Meeting in S. Petersburg, July 2006.

The Courses – Each Student will have to follow 180 hours of courses during the three years of the Ph.D. program. The Courses can be chosen among the following ones. There is also the possibility to follow the courses of the other Physics, Mathematics, Astronomy and Astrophysics Ph.D. programs in each participating institution, after approval by the faculty.

The Field of Relativistic Astrophysics has become one of the fastest progressing fields of scientific development. This is due to the fortunate interaction of a vast number of international observational and experimental facilities in space, on the ground, underground, in the polar ice caps, and in the deep ocean, supported by a powerful theoretical framework based on Einstein’s theory of general relativity and relativistic quantum field theory. In 1995, the International Center for Relativistic Astrophysics in Rome (ICRA) initiated an International Network of Centers in the field of Relativistic Astrophysics (ICRANet) which has this year acquired the status of International Organization. The ICRANet combines the research powers of leading institutions in the Americas, Australia, Asia and Europe. The coordinating center is located in the town of Pescara, Italy. In parallel with these activities, the International Relativistic Astrophysics Ph.D. Program (IRAP PhD) has been created with the goal of training a highly qualified number of Ph.D. students in this exciting field of research. So far, the participating institutions are: ETH Zürich, Freie Universität Berlin, Observatoire de la Côte d’Azur, Université de Nice-Sophia Antipolis, Università di Roma “La Sapienza” and Pescara ICRANet Center by Prof. Vladimir Belinski.

RELATIVITY THEORY

PHYSICS OF GRAVITY

Lectures on the mathematical and physical foundation of general relativity held at the Università di Roma “La Sapienza” by Dr. Dantuno Roni and Prof. Robert T. Jantzen.

HIGH ENERGY UNIVERSE

Lectures delivered at Università di Sivassia by Prof. Pascal Chardonnet.

MATHEMATICAL PROBLEMS OF GENERAL RELATIVITY THEORY

Lectures delivered at ETH Zürich by Prof. Demetrios Christodoulou.

APPLICATIONS TO ASTROPHYSICS

Lectures delivered at Università di Roma “La Sapienza” by Prof. Ugo Moschella.

INTRODUCTION TO STRING THEORY

Lectures delivered at Università di Roma “La Sapienza” by Prof. Thibault Damour.

THE REFERENCE FRAME: FROM EARTH TO CMB

Lectures delivered at Université de Nice Sophia Antipolis by Prof. Simonetta Filippi.

THE BINARY PULSARS: THEORY AND OBSERVATIONS

Lectures delivered at Università di Nice Sophia Antipolis and Pescara ICRANet Center by Prof. Nathalie Deruelle and Prof. Michel Kramer.

THE STRUCTURE, AND DYNAMICS OF SELF-GRAVITATING SYSTEMS

Lectures delivered at Pescara ICRANet Center by Prof. Simonetta Filippi and Alonso Sepulveda.

FERMI-THOMAS MODELS IN ATOMIC PHYSICS AND SELF-GRATING SYSTEMS

Lectures delivered at Università di Nice Sophia Antipolis, Università di Roma “La Sapienza” and Pescara ICRANet Center by Prof. Francesco Garreta and Prof. Remo Ruffini.

CHAOTIC BEHAVIOUR IN ASTROPHYSICAL SYSTEMS AND COSMOLOGY I

Lectures delivered at Pescara ICRANet Center by Prof. Vladimir Belinski and Prof. Simonetta Filippi.

SELECTED TOPICS ON RELATIVISTIC QUANTUM FIELD THEORIES

Lectures delivered at the Freie Universität in Berlin and Pescara ICRANet Center by Prof. Hagen Kleinert and Prof. Axel Fleischhack.

APPLICATION AND FELLOWSHIP

In 2005-2006 eight positions will be available, five with fellowship support. The application deadline is September 30, 2005. See <http://www.icra.rraphd.it>.
The field of relativistic astrophysics has become one of the fastest progressing fields of scientific development. This is due to the fascinating interaction of a vast number of international observational and experimental facilities in space, on the ground, underground, in the polar ice caps, and in the deep ocean, supported by a powerful theoretical framework based on Einstein’s theory of general relativity and relativistic quantum field theory. In 1995, the International Center for Relativistic Astrophysics in Rome (ICRA) initiated an International Network of Centers in the field of Relativistic Astrophysics (ICRANet) which acquired the status of an International Organization in 2003. The ICRANet combines the research powers of leading institutions in the Americas, Australia, Asia and Europe. The coordinating center is located in the town of Pescara, Italy. In parallel with these activities, the International Relativistic Astrophysics Ph.D. Program (IRAP Ph.D) has been created with the goal of training a highly qualified number of Ph.D. students in this exciting field of research. So far, the participating institutions are: ETH Zurich, Freie Universität Berlin, Institut des Hautes Études Scientifiques, Observatoire de la Côte d’Azur, Università di Roma “La Sapienza”, and Università di Savoie. The IRAP Ph.D. is granted by all these institutions. Each program cycle lasts three years. The courses and related scientific activities cover a broad range of scientific topics including the mathematical and geometric structure of spacetime, relativistic field theories of fundamental interactions both at the classical and quantum levels, astronomical and astrophysical observational techniques, and the associated phenomenological and theoretical descriptions. The research style is by its own nature interdisciplinary and international. The students will take courses at all participating institutions.

This is the announcement of the 5th IRAP Ph.D. cycle. In addition to the courses and research on relativistic field theory, black holes and cosmology, the Graduate School will take part in the Eleventh Marcel Grossmann Meeting in Rome, July 2006, in the 12th Brazilian School on Cosmology and Gravitation in September 2006, in the General Relativity Trieste Summer School at the Town of Emile Borel at the Institute Henri Poincaré October-December 2006 and will also take part in topical seminars in the ICRANet centers in Rome, at the University of Nice “La Sapienza” as well as at the University of Nice-Sophia Antipolis during all three years of this cycle.

The Courses – Each student will have to follow 180 hours of courses during the three years of the Ph.D. program. There is also the possibility to follow courses from the other Physics, Mathematics, Astronomy and Astrophysics Ph.D. programs in each participating institution, after approval by the faculty. Courses can be chosen from the following list:

- Chaotic Behaviour in Astrophysical Systems and Cosmology I
- Chaotic Behaviour in Astrophysical Systems and Cosmology II
- Generalized Kaluza-Klein Theories
- Special Topics in Relativistic Quantum Field Theories
- High Accuracy Astrometry and Relativity
- Introductory to String Theory
- The Structure and Dynamics of Self-Gravitating Systems
- Non-Linear Dynamics and Applications to Astrophysics
- Selected Topics in Relativistic Quantum Field Theories
- Mathematical Problems of General Relativity Theory
- Theoretical Physics
- Advanced General Relativity
- High Accuracy Astrometry and Relativity
- Advanced General Relativity
- Selected Topics on Gamma-Ray Burst Theory
- Selected Topics in Relativistic Quantum Field Theories
- High Accuracy Astrometry and Relativity
- Strategic Behavior in Astrophysical Systems and Cosmology I
- Strategic Behavior in Astrophysical Systems and Cosmology II
- The Host Institution for the call of 2006-2007 in the University of Nice Sophia Antipolis Grand Chateau 29 Avenue Valrose 21 B.P. 2135
- Measure 101 NICE CEDEX 2

The Faculty

- Hagen Kleinert
- Remo Ruffini
- Simona Filippi
- Hsiu Chang
- Tecnico Universitaet Berlin
- Olivier Michel
- Universitaet di Roma ‘La Sapienza’
- Jose Pacheco
- Università di Roma ‘La Sapienza’
- Istituto Nazionale di Fisica Nucleare
- Università di Roma ‘La Sapienza’
- Università di Roma ‘La Sapienza’
- Università di Roma ‘La Sapienza’
- Università di Roma ‘La Sapienza’

Application and Fellowship

In 2006-2007 nine positions will be available, six with fellowship support. The application deadlines is July 31, 2006. See http://www.icra.it/IRAPPhD.
the International Relativistic Astrophysics Ph.D. Program (IRAP PhD) at CERN, which is operated by IRONnet, has been created with the goal of training a highly qualified number of Ph.D. students in this exciting field of research. To do so, the participating institutions and ETH Zurich, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg University, Fribourg 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The International Relativistic Astrophysics Ph.D. Program (IRAP Ph.D) is a research-oriented Ph.D. program created with the goal of training a select number of highly qualified Ph.D. students to conduct original field research. It is the realization of a long-standing joint effort, and it is the first of its kind in Italy. The research interests of the IRAP Ph.D. Program are in the fields of relativistic astrophysics and related areas.

The IRAP Ph.D. Program is part of the International Center for Relativistic Astrophysics (ICRANet), a non-profit international organization with headquarters in Pescara, Italy. ICRANet is an International Organization with the mission to foster international collaboration in all fields of scientific research. Since its inception in 2005, ICRANet has initiated an International Network of Relativistic Astrophysics (ICRANet) dedicated to the promotion of international collaboration in the theoretical field of Relativistic Astrophysics. The IRAP Ph.D. Program is one of the projects funded by ICRANet.

The IRAP Ph.D. Program is also an associate member of the National Research Council of Italy (CNR) and is affiliated with the University of Rome “La Sapienza.” The Ph.D. program is located in the Department of Physics, Mathematics, Astronomy, and Astrophysics of the University of Rome “La Sapienza.”

The IRAP Ph.D. Program is open to students from all over the world and is designed to provide a high-quality education in the field of relativistic astrophysics. The program is structured to provide students with the opportunity to conduct original research in the field, and it is supported by a team of experienced and accomplished faculty members.

The courses offered by the IRAP Ph.D. Program are designed to provide students with a solid foundation in the theoretical and experimental aspects of relativistic astrophysics. The program offers a variety of courses in areas such as theoretical relativity, quantum field theory, and astrophysical processes. Students are also encouraged to participate in seminars and workshops and to work closely with faculty members to develop their research projects.

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The IRAP Ph.D. Program is an excellent opportunity for students who are interested in pursuing a career in relativistic astrophysics. The program provides a high-quality education in the field, and it is supported by a team of experienced and accomplished faculty members. Students are also encouraged to participate in seminars and workshops and to work closely with faculty members to develop their research projects.

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the International Relativistic Astrophysics Ph.D.

INVITATION FOR APPLICANTS 2009

Following the successful scientific space missions by the European Space Agency (ESA) and the European Southern Observatory (ESO) in Chile, as well as the high-energy particle activities at CERN in Geneva, we have created a Ph.D. program dedicated to the formation of scientists in the field of relativistic astrophysics. The students of such a program will lead the theoretical developments of one of the most active fields of research, based on the above observational and experimental facilities. This program needs expertise in the most advanced topics of mathematical and theoretical physics, and in relativistic field theories. It requires the ability to model the observational data received from the above facilities, as well as all the basic knowledge in astronomy, astrophysics and cosmology. This activity is necessarily international, no single university can cover the broad topics. From this, the proposed program of the IRAP Ph.D., in one of the youngest and most dynamical French universities, role of research and teaching in the Euro-Mediterranean region (EMES): the University of Nice. Benefiting from the presence of the astrophysics research institute of Observatoire de la Côte d’Azur involved in relativistic and non-photonic astrophysics as well as the presence of Turin Observatory. The participation of the Free University Berlin and of the Erasmus Institute in Padua offers the possibility of teaching in relativistic field theories at the highest level. The University of Sapienza offers the link to the particle physics at CERN. The activities at the University of Rome, at Stockholm University, and at ICRANet offer teaching programs in all fields of relativistic astrophysics, including cosmology, the physics of gravitational collapse, gamma-ray bursts, and black hole physics. Finally, the University of Ferrara will present with lectures and researches in the topic they have pioneered such as X-ray astrophysics and observational cosmology. Through ICRANet, the extra-European connections with Brazil, China and India will be guaranteed: in China, with the Shanghai Observatory of the Chinese Academy of Science, studying the formation and evolution of large-scale structure and galaxies, in India, with the Indian Centre for Space Physics (ICSP), renowned in the research on compact objects, as well as in solar physics and astrophysics; in Brazil, with ICRANet in Belford, where a successful program of research and teaching in relativistic astrophysics has been established in recent years.

The Courses – Each student will have to follow 180 hours of courses during the three years of the Ph.D. program. There is also the possibility to follow courses from the other Physics, Mathematics, Astronomy and Astrophysics Ph.D. programs in each participating institution, after approval by the faculty. Courses can be chosen from the following list:

- CORE LECTURES
  - ULTRA HIGH ENERGY GAMMA RAY SOURCES
    - Colin AMARIDHAN (ICRANet & Max Planck)
  - THE APPROACH TO THE SINGULARITY
    - Thibault DAMOUR (ICRANet & IHES)
  - RELATIVISTIC EFFECTS IN GBRS
    - Carlo BIANCO (ICRANet)
  - ACCRETIONS ON BLACK HOLES AND NEUTRONS STARS
    - Sandip CHAKRABARTI (Indian Centre for Space Physics)
  - PARTICLE PHYSICS APPLIED TO ASTROPHYSICS
    - Filippo FRONTERA (Ferrara University)
  - EXOBIOLGY
    - Sandip CHAKRABARTI (Indian Centre for Space Physics)
  - GENERAL RELATIVITY
    - Michel ZAMUDIO (ICRANet & IHES)
  - LARGE SCALE STRUCTURE OF THE UNIVERSE
    - Juan EINASTO (ICRANet & Tartu Observatory)
  - SIGNAL TREATMENT
    - Andrei FERKARI (Nice University)
  - X-RAYS AND GAMMA RAYS ASTRONOMY
    - Filippo FRONTERA (Ferrara University)

- CLUSTERS
  - Riccardo GIACCONI (ICRANet)

- PLANETOLOGY
  - Sandro GIURATI (Observatoire de la Côte d’Azur)
  - FORMATION OF GALAXIES
    - Remo RUFFINI (Free University Berlin)
  - ON THE KERR SOLUTION
    - Roy KERR (ICRANet)
  - RELATIVISTIC FIELD THEORY
    - Remo RUFFINI (Free University Berlin)
  - PLANETOLOGY
    - Filippo FRONTERA (Ferrara University)
  - DEVELOPMENT OF BIG WAVE TURBULENCE
    - Jean Arnaud (SAPIENZA Università di Roma)
  - NON-SYMMETRIC COSMOLOGY
    - Mario NOVELLO (ICRANet & ENS)
  - EXTRAGALACTIC ASTROPHYSICS
    - Josué PACHECO (SAPIENZA Università di Roma)
  - SINGULARITIES AND GENERAL RELATIVITY
    - Yuji ROSKAN (Stockholm University)

- BLACK HOLES AND FUNDAMENTAL PHYSICS
  - Emanuele BERTI (SAPIENZA Università di Roma & Roma Sapienza)

- THERMALIZATION AND COLLECTIVE EFFECTS
  - Gregory VERESHACHING (ICRANet & IHES)

- GRAVITATIONAL WAVES
  - Roger MACCIE (Observatoire de la Côte d’Azur)
  - ULTRA RELATIVISTIC ELECTRON POSITION PLASMA
    - Shuang XUE (ICRANet)

- The Host Institution for the call of 2009-2010
  - SAPIENZA Università di Roma
  - IRAP (Observatoire de la Côte d’Azur)
  - ENS (IHES)

- Applications and Fellowship:
  - In 2009-2010 at least 6 positions will be available, six with fellowship support.

- The application deadline is September 15, 2009.

- Information:
  - Bert Armida
  - tel. +39 06 49914254
  - e-mail: secretariat@iraphd.it

- The Faculty:
  - Giovanni Montani
  - Sergio Frasca
  - Sandro Chakrabarti
  - Jean Arnaud
  - Roy Kerr
  - Sandro Giurati
  - Michelle Zamudio
  - Jose Pacheco
  - Remo Ruffini (Director)
  - Sandro Giurati
  - Michel Zamudio
  - Remo Ruffini
  - Jean Arnaud
  - Roy Kerr
  - Sandro Giurati
  - Michelle Zamudio
  - Remo Ruffini
  - Jean Arnaud
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  - Roy Kerr
  - Sandro Giurati
  - Michelle Zamudio
  - Remo Ruffini

- The Department:
  - SAPIENZA Università di Roma
  - IRAP (Observatoire de la Côte d’Azur)
  - ENS (IHES)

- The European Southern Observatory (ESO)
  - Chilean and European Observatories

- The European Space Agency (ESA)
  - To receive the information

- The Erasmus Institute
  - Padua

- The University of Nice
  - Sophia Antipolis

- The University of Sapienza
  - Rome
the International Relativistic Astrophysics Ph.D.
Erasmus Mundus Joint Doctorate Program

The IRAP PhD, sponsored by Erasmus Mundus, is dedicated to the formation of scientists in the field of relativistic astrophysics. The successful scientific space missions by the European Space Agency (ESA), the Very Large telescope of the European Southern Observatory (ESO) in Chile, as well as the high-energy particle activities at CERN in Geneva have created the basis for a vigorous development of the field of relativistic astrophysics. This has become one of the most active fields of current research.

This program provides expertise in the most advanced topics of mathematical and theoretical physics, including relativistic field theories, in the context of astronomy, astrophysics and cosmology. This activity is necessarily international – no single university can cover this broad scientific scope.

The first three-year program cycle starts in 2010 at the University of Nice Sophia Antipolis. It benefits from the presence of the astrophysics research institute of the Observatoire de la Côte d’Azur. The coordination of the IRAP PhD will take place at the Center of ICRANet at Villa Ratti, close to the university campus. The Free University Berlin and the Einstein Institute in Potsdam contribute with teaching in relativistic field theories. The University of Savoie connects to the particle physics at CERN. The activities at the University of Rome, at Stockholm University, and at ICRAS and ICRANet offer teaching programs in all fields of relativistic astrophysics, including cosmology, the physics of gravitational collapse, gamma-ray bursts, and black hole physics. The University of Ferrara takes part with lectures and research in observational astronomy and development of space missions. In addition, the students can follow graduate courses at all the participating institutions.

Through ICRANet the extra-European connections with Brazil, China and India will be guaranteed with China via the Shanghai Observatory of the Chinese Academy of Science, with India via the Indian Centre for Space Physics in Kolkata and with Brazil via the Rio de Janeiro branch of ICRANet.

**GENERAL RELATIVITY**
- ADVANCED GENERAL RELATIVITY
- RELATIVISTIC FIELD THEORY
- PARTICLE PHYSICS APPLIED TO ASTROPHYSICS
- SINGULARITIES IN GENERAL RELATIVITY
- ROTATING AND ELECTROMAGNETIC BLACK HOLES
- GRAVITATIONAL WAVES
- BLACK HOLES AND FUNDAMENTAL PHYSICS
- ACCRETION ON BLACK HOLES AND NEUTRONS STARS
- X-RAY AND GAMMA RAY ASTRONOMY

**ULTRA RELATIVISTIC ELECTRON POSITRON PLASMA**
- ULTRA RELATIVISTIC ELECTRON POSITRON PLASMA
- RELATIVISTIC EFFECTS IN GAMMA RAY BURSTS
- SUPERNOVA
- ULTRA HIGH ENERGY GAMMA RAY SOURCES
- FORMATION OF GALAXIES
- EXTRAGALACTIC ASTROPHYSICS
- LARGE SCALE STRUCTURE OF THE UNIVERSE
- NON-SINGULAR COSMOLOGY
- SIGNAL TREATMENT IN ASTROPHYSICS
- PLANETOLOGY
- EXOPLANETS

**INTERNATIONAL CENTER FOR RELATIVISTIC ASTROPHYSICS (ICRAS) and UNIVERSITY OF ROMA LA SAPIENZA, ROME, ITALY**
- Prof. Remo RUFFINI, IRAP PhD director
- (ruffini@cracnet.it)

**UNIVERSITY OF SAVOIE, ANNECY, FRANCE**
- Prof. Pascal CHARDONNET, Erasmus Mundus coordinator (chardonnet@lapp.in2p3.fr)
- INDIAN CENTRE FOR SPACE PHYSICS, KOLKATA, INDIA
- Prof. Sandip Kumar CHAKRABARTI (chakrab@bose.res.in)
- UNIVERSITY OF NICE-SOPHIA ANTIPOLIS, NICE, FRANCE
- Prof. Pierre COULLET (pierre.coullet@unice.fr)
- TARTU OBSERVATORY, TARTU, ESTONIA
- Prof. Juan ENASTO (j.enasto@aa.le.ac.uk)
- UNIVERSITY OF FERRARA, FERRARA, ITALY
- Prof. Filippo FRONTERA (fronteraf@fe.infn.it)
- UNIVERSITY OF ROMA LA SAPIENZA, ROME, ITALY
- Prof. Yipeng JING (ypjing@shao.ac.cn)
- FREE UNIVERSITY OF BERLIN, BERLIN, GERMANY
- Prof. Hagen KLEINERT (hagens@aei.mpg.de)
- ALBERT EINSTEIN INSTITUTE, POTSDAM, GERMANY
- Prof. Hermann NICOLAI (hermann.nicolai@aei.mpg.de)
- BRAZILIAN CENTRE FOR PHYSICS RESEARCH, RIO DE JANEIRO, BRAZIL
- Prof. Mario NOVELLO (novello@clp.br)
- STOCKHOLM UNIVERSITY, STOCKHOLM, SWEDEN
- Prof. Kent ROQUICKI (kro@fysik.su.se)
- OBSERVATORY OF THE COTE D’AZUR, NICE, FRANCE
- Prof. Farrokh VAKILI (farrokh.vakili@oca.eu)

**SHANGHAI ASTRONOMICAL OBSERVATORY, SHANGHAI, CHINA**
- Prof. Yiping JING (ypjing@shao.ac.cn)

**IRAP PhD**

**Deadline for Application:**
- February 28, 2010

**For information contact:**
- Pina Barbaro - EDS (Barbano@u.nice.fr)
- 06 10 8 Nice Cedex 2
the International Relativistic Astrophysics Ph.D.

INVITATION FOR APPLICANTS 2010

Following the successful scientific space missions by the European Space Agency (ESA) and the European Southern Observatory (ESO) in Chile, as well as the high-energy particle activities at CERN in Geneva, we have created a Ph.D. program dedicated to the formation of scientists in the field of relativistic astrophysics. The students of such a program will lead the theoretical developments of one of the most active fields of research, based on the above observational and experimental facilities. This program provides expertise in the most advanced topics of mathematical and theoretical physics, and in relativistic field theories, in the context of astronomy, astrophysics and cosmology. It provides the ability to model the observational data received from the above facilities. This activity is necessarily international, no single university can cover the broad expertise.

The proposed program of the IRAP Ph.D. enjoys the collaboration of some of the most famous European Universities with one of the youngest and most dynamical French universities, the University of Nice-Sophia Antipolis. Also it benefits from the presence of the Observatoire de la Côte d’Azur and the presence of the ICRA Net Center at Villa Ratti in Nice, where the coordination of the IRAP Ph.D. will take place. The astronomical aspects of the large scale of the Universe will be illustrated by the teaching by the Tartu Observatory. The activities at ICRA Net Centers, at the ETH of Zurich, at the University of Rome, at Stockholm University offer teaching programs in all the fields of relativistic astrophysics, including cosmology, the physics of gravitational collapse, gamma-ray bursts, and black hole physics. The participation of the Freie Universität Berlin and of the University of Potsdam offers the possibility of teaching in relativistic field theories at the highest level. The University of Savoie offers the link to the particle physics at CERN. The University of Ferrara will be present with lectures and researches in the topics they have pioneered such as instrumentation developments and data analysis for X and Gamma ray astrophysics and observational cosmology.

The astronomical aspect of the large scale of the Universe will be illustrated by the teaching by the Tartu Observatory. The activities at ICRA Net Centers, at the ETH of Zurich, at the University of Rome, at Stockholm University offer teaching programs in all the fields of relativistic astrophysics, including cosmology, the physics of gravitational collapse, gamma-ray bursts, and black hole physics. The participation of the Freie Universität Berlin and of the University of Potsdam offers the possibility of teaching in relativistic field theories at the highest level. The University of Savoie offers the link to the particle physics at CERN. The University of Ferrara will be present with lectures and researches in the topics they have pioneered such as instrumentation developments and data analysis for X and Gamma ray astrophysics and observational cosmology.

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Through ICRA Net the extra-European connections with Brazil, China and India will be guaranteed: in China, with the Shanghai Observatory of the Chinese Academy of Science, studying the formation and evolution of large-scale structures and galaxies; in India, with the Indian Centre for Space Physics (ICSP), renowned for its research on compact objects as well as on solar physics and astrophysics in Brazil, with ICRA BRF at CBPF and the Rio de Janeiro branch of ICRA Net, where a successful program of research and teaching in relativistic astrophysics has been established in recent years.

The Courses: Each student will have to follow 180 hours of courses during the three years of the Ph.D. program. There is also the possibility to follow courses from the other Physics, Mathematics, Astronomy, and Astrophysics Ph.D. programs in each participating institution, after approval by the faculty. Courses can be chosen from the following list:

### VERY HIGH ENERGY PHENOMENA IN ASTROPHYSICS
- Felix Aharonian
- Dubin Institute for Advanced Studies and Max Planck Institute for Kerpheysics

### COSMOLOGICAL SINGULARITY
- Vladimir Belinskii
- ICRA Net

### RELATIVISTIC EFFECTS IN ASTROPHYSICS
- Carlo Luciano Bianco
- ICRA Net

### ACCRECTIONS ON BLACK HOLES
- Sandip Chakrabarti
- S.N. Bose Centre and Indian Centre for Space Physics

### PARTICLE PHYSICS APPLIED TO ASTROPHYSICS
- Pascal Chardonnet
- University of Savoie

### GENERAL RELATIVITY
- Thibault Damour
- CERN & IRAP

### SUPERNOVAE AND CORES
- Maximino Della Valle
- ICRA Net

### LARGE SCALE STRUCTURE
- Jaap Einasto
- Tartu Observatory & ICRA Net

### X/GAMMA-RAY INSTRUMENTATION
- Filippo Frontera
- University of Ferrara

### HIGH ENERGY ASTROPHYSICS: X-RAYS CLUSTERS
- Riccardo Giacconi
- ICRA Net

### OBSERVATIONS OF GAMMA-RAY BURSTS
- Cristiano Guidorzi
- University of Ferrara

### FORMATION OF GALAXIES
- Yiqing Jing
- Shanghai Observatory

### ON THE KERR SOLUTION
- Roy Kerr
- ICRA Net

### RELATIVISTIC FIELD THEORY
- Hagin Kleinert
- Freie Universität Berlin

### BLACK HOLES AND FUNDAMENTAL PHYSICS
- Remo Ruffini
- ICRA Net & University Roma La Sapienza

### COLLECTIVE EFFECTS IN ASTROPHYSICS
- Gregory Vereshchagin
- ICRA Net

### ULTRA RELATIVISTIC ELECTRON POSTION PLASMA
- She-Sheng Xue
- ICRA Net

The Host Institution for the call of 2010-2011 is the University of Nice Sophia Antipolis Grand Château 28 Avenue Victor Hugo 21 - B.P. 2135 06103 NICE CEDEX 2

Applications and fellowship: In 2010-2011 ten positions will be available, six with fellowship support. The application deadline is September 10th, 2010. See http://www.icra.it and http://www.icranet.org

Information:
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tel. + 39 06 4991 4397
e-mail: bisanco@icra.it

The Faculty
Giovanni Amelino-Camelia
“Institute to the Universities of Roma and Potsdam
Jean Arnaud
Université de Nice Sophia Antipolis

Carlo Luciano Bianco
Sapienza University of Rome and ICRA

Daniele Bini
CMS – U. del C. del C. M. Picone
Pascal Chardonnet
Freie Universität Berlin

Hermann Nicolai
Université de Nice Sophia Antipolis
Christiaan Chenab
Université “Campus Brno” of Roma

Domenico Christodoulou
ETH Zurich

Paolo Cealetti
Université de Nice Sophia Antipolis
Teresa D'Amore
CBPF Brazil and ICRA Net

Mario Novello
ICRA Net & University Roma La Sapienza

Remo Ruffini
ICRA Net & University Roma La Sapienza

Ypeng Jing
Sapienza University of Roma and ICRA Net

Institutes:
Sapienza University of Roma

ICRA Net

CBPF Brazil and ICRA Net

Observatoire de la Côte d’Azur

Padiou Kerdraon
Stockholm University

Remo Ruffini (Director)

Sapienza University of Roma and ICRA Net

Maria Gabriella

Observatoire de la Côte d’Azur

Shao-Sheng Xue

ICE Net

Filippo Frontera
Universita di Firenze

Hagen Kleinert
Freie Universität Berlin

Gambara Lippi
Università di Roma La Sapienza

Francois Mignard
Université de Côte d’Azur

Giovanni Montani
DEA and ICRANet

Heinemann Nicollia
Max Planck Inst. for Gravitational Physics, Postdam

Joaquim Padilha
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Kiplil Rouxgard
Stockholm University

Remo Ruffini (Director)

Sapienza University of Roma and ICRA Net

Farouk Vakili

Observatorio de la Côte d’Azur

Shao-Sheng Xue

ICE Net

StamP Palombi & Partner - Roma - Maggio 2010
the International Relativistic Astrophysics Ph.D. Erasmus Mundus Joint Doctorate Program

Following the successful scientific space missions by the European Space Agency (ESA) and the European Southern Observatory (ESO) in Chile, as well as the high-energy particle activities at CERN in Genève, we have initiated a Ph.D. programme dedicated to create a pool of scientists in the field of relativistic astrophysics. After taking full advantage of the observational and experimental facilities mentioned above, the students of our programme are expected to lead the theoretical developments of one of the most active fields of research: relativistic astrophysics. This program provides expertise in the most advanced topics of mathematical and theoretical physics, and in relativistic field theories, in the context of astronomy, astrophysics and cosmology. It provides the ability to model the observational data received from the above laboratories. This activity is necessarily international as no single university can have a scientific expertise in such a broad range of fields.

We announce two calls with a deadline on 28 February 2011, sponsored by Erasmus Mundus, and the other with a deadline on 30 September 2011. The Erasmus Mundus program has a very competitive salary as well as comprehensive benefits.

The Institutions participating in the IRAP PhD are: the international organization ICRA Net as coordinating institution and the University of Nice Sophia Antipolis as the host Institution; the Albert Einstein Institute, Potsdam; the Brazilian Center for Physics: Research (CBPF) and ICRA Brasil; the Free University of Berlin, Indian Centre for Space Physics, Kolkata; Observatoire de la Côte D’Azur, Nice; Shanghai Astronomical Observatory, China; University of Ferrara, Italy; University of Rome, la Sapienza, Italy; University of Savoie, Annecy, France; University of Stockholm, Sweden, Tartu Observatory, Estonia. The Final Ph.D. degree will be jointly delivered by the Academic Institutions participating in the program.

We encourage applications from the most qualified and motivated candidates worldwide, independent of nationality, gender or background.

The Courses: Each student will have to follow 180 hours of courses during the three years of the Ph.D. program. There is also a possibility to follow courses from other Physics, Mathematics, Astronomy and Astrophysics Ph.D. programs at participating institutions, after approval by the Faculty. Courses can be chosen from the following list:

**VEH HIGH ENERGY PHENOMENA IN ASTROPHYSICS**
Felix Aharony
Dublin Institute for Advanced Studies and Max Planck Institutefur Kernphysik

**RELATIVISTIC EFFECTS IN ASTROPHYSICS**
Carlo Luciano Bianco
Università di Roma and ICRA Net

**OBSEVERS AND OBSERVATORIES IN BLACK HOLE SPACE TIMES**
Donato Bini - CNR and ICRA Net

**ACCETATIONS ON BLACK HOLES**
Sandip Kumark Chakrabarti
S.N. Bose National Centre and Indian Centre for Space Physics

**PARTICLE PHYSICS APPLIED TO ASTROPHYSICS**
Fascal Chardonnnet
University of Savoie and ICRA Net

**GENERAL RELATIVITY**
Thierry Damour
BHS and ICRA Net

**SUPERNOVAE AND GRBs**
Massimo Della Valle
Osservatorio A stronomico di Capodimonte and ICRA Net

**LARGE SCALE STRUCTURE**
Jean Einasto
Tartu Observatory and ICRA Net

**TOPICS IN COSMOLOGY AND PARTICLE ASTROPHYSICS**
Li Zhi Fang
University of Arizona and ICRA Net

**HIGH ENERGY PHYSICS X-RAYS CLUSTERS**
Riccardo Giacconi
ICRA Net

**OBSERVATIONS OF GAMMA-RAY BURSTS**
G. Casadozzi
Università di Roma and ICRA Net

**FORMATION OF GALAXIES**
Yipeng Jing - Shanghai Observatory

**ON THE KERR SOLUTION**
Roy Kerr - ICRA Net

**RELATIVISTIC FIELD THEORY**
Hagen Allmén
Freie Universität Berlin and ICRA Net

**HOLOGRAPHY, ENTROPY GRAVITY AND COSMOLOGY**
Mario Tavani
INAF-IFAM Rome and Università di Roma “Tor Vergata”

**SPECTRAL TIMING FROM BLACK HOLE SOURCES**
Lev Titarchuk - University of Ferrara

**RELATIVISTIC KINETIC THEORY**
Egidio Vireluz-Hagan
Università di Roma and ICRA Net

**BLACK HOLES AND FUNDAMENTAL PHYSICS**
Riccardo Giacconi
Università di Roma and ICRA Net

**THE HIGH-ENERGY GAMMA-RAY UNIVERSE**
Mario Tavani
INAF-IFAM Rome and Università di Roma “Tor Vergata”

For further information please contact:
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Max Planck Institutefur Kernphysik

Jaan Einasto
University of Ferrara, Italy

Sapienza University of Rome

Herman Nicolai
Max Planck Institutefur Gravitationsphysik, Potsdam

Pietro Covino
University of Rome, la Sapienza, Italy

For information and application details, see http://www.icra.it and http://www.icranet.org
Following the successful scientific space missions by the European Space Agency (ESA) and the European Southern Observatory (ESO) in Chile, as well as the high energy particle activities at CERN in Geneva, we have initiated a Ph.D. programme dedicated to create a pool of scientists in the field of relativistic astrophysics. After taking full advantage of the observational and experimental facilities mentioned above, the students of our programme are expected to lead the theoretical developments of one of the most active fields of research: relativistic astrophysics.

This programme provides expertise in the most advanced topics of mathematical and theoretical physics, and in relativistic field theories, in the context of astrophysics, cosmology and cosmology. It provides the ability to model the observational data received from the above laboratories. This activity is necessarily international as no single university can have a scientific expertise in such a broad range of fields.

We encourage applications from the best candidates worldwide, independent of nationality, gender or background.

The Courses: Each student will have to follow 180 hours of courses during the three years of the Ph.D. program. There is also a possibility to follow courses from other Institutions participating in the program after approval by the Faculty. Courses can be chosen from the following list.

- **Particle Physics, Applied to Astrophysics**: Pascal Charbonnet, University of Savoie and ICRANet
- **General Relativity**: Tilman Davoudiasl, ICRANet and ICRANet
- **SuperNovae and GeRs**: Massimo della Valle, University of Palermo and ICRANet
- **Large Scale Structure**: J. L. Aprahamian, Tata Institute of Fundamental Research and ICRANet
- **Cosmology and Particle Astrophysics**: U. Zepf, University of Arizona and ICRANet
- **Cosmological Singularity**: Vladimir Belinski, ICRANet
- **Relativistic Effects in Astrophysics**: Carlo Luciano Bianco, ICRANet
- **Cosmological Singularities**: Sapienza Università di Roma and ICRANet
- **Observations and Observables in Black Hole Spacetimes**: Donato Bini, CNR and ICRANet
- **Accretions on Black Holes**: Sandro Manfredini, ICRANet
- **Stellar Nucleosynthesis and Galactic Dynamics**: S.N. Bose National Centre and Indian Centre for Space Physics
- **High Energy Phenomena in Astrophysics**: Francesco barbera, IAP and ICRANet
- **Relativistic Field Theory**: Hagen Kleinert, Free University of Berlin and ICRANet
- **Bounding Cosmology**: Mario Noulouvo - CBPF Brazil and ICRANet
- **X-ray Bolometric Observations**: Riccardo Giacconi, ICRANet
- **X-Ray and Gamma-Ray Physics**: Roy Kerr - ICRANet
- **Thermodynamics and Radiation Theory**: Kell Roaquist - Stockholm University
- **The High Energy Gamma-Ray Universe**: Marco Cavaliere, University of Rome and ICRANet
- **Strong Coupling QCD and Electron-Positron Plasma**: Shi Zheng, Peking University
- **Theories on Gamma-Ray Bursts**: Bing Zhang, University of Nevada Las Vegas
- **X-Ray Astrophysics**: Shuangnan Zhang, University of Arizona and ICRANet
- **Force and Fundamental Physics**: Romo Rufini, University of Rome and ICRANet
- **Cosmological Kinetic Theory**: Vieri Bessore, Virgo Collaboration
- **Spectral Timing from Black Hole Sources**: Lev Titarchuk, University of Ferrara
- **Cosmology and Hidden Symmetries in Gravity**: Hermann Nicolai, Max-Planck-Institut für Gravitationsphysik (Albert Einstein Institute)
- **Theories on Gamma-Ray Bursts**: Bing Zhang, University of Nevada Las Vegas
- **X-Ray Astrophysics**: Shuangnan Zhang, University of Arizona and ICRANet
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- **Theories on Gamma-Ray Bursts**: Bing Zhang, University of Nevada Las Vegas

For further information please contact:
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Applications and information: In the call of September 10, 2012 (four additional fellowships will be available: two with full financial support and two with partial financial support), for further information please contact: http://www.irap-phd.org or http://www.icranet.org.

The Host Institution for the call of 2012-2015 is the Università di Pisa-Sopra Antiqua, University of Chateauroux in France, University of the Americas in Chile.