

# National PhD School of Astrophysics Scuola Nazionale di Dottorato in Astrofisica

## "Francesco Lucchin"

*Asiago, 24 - 30 October 2010*

This is the first announcement of the National School in Astrophysics for PhD to be held at the Department of Astronomy of the Padova University in Asiago (Vicenza, Italy) from 24 through 30 October 2010.

### **Aims of the School**

The school is mainly designed for students of PhD program in Astronomy and Physics. It is however open also to interested young researches. The school aims to increase the basic training in Astronomy and Astrophysics, presenting a series of lectures on forefront topics, both observational and theoretical, of the international research. The topics covered by the school are

#### **1. GAIA: the milestone of the distance scale**

(Director: Mario Lattanzi)

Gaia, a cornerstone-class mission, is the next global space astrometry initiative of the European Space Agency targeted to reach the 25 micro-arc-second level accuracy. Its goal is to make the largest, most precise three-dimensional map of our Galaxy by surveying over five years more than a thousand million stars down to  $V=20$  magnitude. The survey is complemented with multi color photometry and, with coverage limited to  $V=17$ , radial velocity measurements. The Gaia launch is now foreseen for the fall of 2012 and the release of the final, full accuracy, science catalog to the community worldwide is anticipated for the end of 2020, early 2021. However, ESA has decided that early/intermediate quality data of limited

accuracy but potentially suitable to address prime science will be released to the scientific community at large even during Gaia's operational life.

The school is intended to provide PHD students and young researchers with the latest on the Gaia mission and present in detail selected topics of the vast science case that motivated the mission and will be revolutionized by its results. In particular, the school will focus on those aspects connecting to the role that the deep probing of the Milky Way properties allowed by Gaia will have in testing present-day predictions of cosmological models. After an introductory lecture on modern astrometry and its contribution to the solution of outstanding problems in 21st century science, Session I will detail on the status of the Gaia mission and on the complexities of the global astrometric problem from space. Session II will then show how to model astrometric (angular) measurements in General Relativity and the experiments planned to test to unprecedented levels the description that this theory provides of the local (Solar System) space-time. Session III is entirely dedicated to stellar astrophysics, dealing with the distance scale after Gaia and the three most conspicuous constituents of our Galaxy (disk, bulge, and halo) as seen through the properties of the stellar groups of which they are made, and as cosmological products. Finally, the last Session will address the unique population of extra-solar planets that Gaia will be able to measure to within the first 200pc from the Sun, and its impact on current theories of planetary formation and evolution.

### ***Plan of the Lectures*** (15h)

#### **-Introduction**

Astrometry in the Era of Cosmology, M. Lattanzi (INAF-OATo) (1h)

#### **-Session I: The Gaia mission (3h)**

Status of the Gaia Mission, J. de Bruijne (ESA, ESTEC) (1h) - TBC

Gaia's global astrometry, L. Lindegren (University of Lund, S) (2h) -TBC

#### **-Session II: Fundamental Physics (3h)**

Relativistic Astrometry, A. Crosta (INAF-OATo) (1.5 h)

Experiments in Fundamental Physics, A. Vecchiato (INAF-OATo) (1.5 h)

-Session III: Selected Topics in Stellar astrophysics (6h)

The distance scale in the Gaia era, G. Clementini (INAF-OABo) (2h)

Stellar populations and the Galactic disk (and Bulge), A. Vallenari (INAF-OAPd) (2h)

Stellar populations and the Galactic Halo, R. Bellazzini (INAF-OABo) (2h)

-Session IV: Probing the first 200pc: Extra-solar planets in Gaia

The Gaia contribution to the science of Extra-solar planets, A. Sozzetti (INAF-OATo) (2h)

## **2. The Infrared Universe: the Herschel and Alma eras**

(Directors: Cesare Chiosi & Giulia Rodighiero)

Herschel is the fourth 'cornerstone' mission in the ESA science programme. With a 3.5 m Cassegrain telescope it is the largest space telescope ever launched. It is performing photometry and spectroscopy in approximately the 50-670 micron range, bridging the gap between earlier infrared space missions and ground-based facilities. Herschel has been designed to observe the 'cool universe'; it is observing the structure formation in the early universe, resolving the far infrared cosmic background, revealing cosmologically evolving AGN/starburst symbiosis and galaxy evolution at the epochs when most stars in the universe were formed, unveiling the physics and chemistry of the interstellar medium and its molecular clouds, the wombs of the stars, and unravelling the mechanisms governing the formation of and evolution of stars and their planetary systems, including our own solar system, putting it into context. In short, Herschel is opening a new window to study how the universe has evolved to become the universe we see today, and how our star the sun, our planet the earth, and we ourselves fit in. Herschel is operated as an observatory facility. It is available to the worldwide scientific community, roughly two thirds of the observing time is 'open time' allocated through standard competitive calls for observing proposals. The future of the infrared astronomy is nowadays represented by ALMA, built by ESO

together with its international partners. ALMA is the state-of-the-art telescope catching light in the millimeter and sub-millimeter pass-bands and therefore suited to study light from some of the coldest objects in the Universe, e.g. . the vast cold clouds in interstellar space and some of the earliest and most distant galaxies in the Universe. Astronomers can use it to study the chemical and physical conditions in molecular clouds in which new stars are being born. ALMA is the most powerful telescope for observing the cool Universe — molecular gas and dust as well as the relic radiation of the Big Bang. ALMA will study the building blocks of stars, planetary systems and galaxies, thus allowing astronomers to address some of the deepest questions of our cosmic origins. ALMA's construction will be completed around 2012, but early scientific observations with a partial array will begin around 2011.

The school is intended to provide PHD students and young researchers with the latest on the Herschel and ALMA. For both subjects the focus will be on the early universe. After an introductory lecture on the science feasible with Herschel and ALMA, Session II will describe Herschel and its instrumentation, Session III will report on the current IR surveys and the physical results obtained in so far, Session IV will deal with the spectroscopy by Herschel, Session V will present in detail the theoretical approach to spectral energy distribution in the IR of galaxies in their early stages, finally Session VI will present the future IR sub-millimeter observations as expected from ALMA.

***Plan of the lectures (15 h)***

-Session I: Introduction TBD (1h)

-Session II: The Herschel mission: instrumentation, M. Vaccari, (OA-Firenze, INAF) (2h)

-Session III: IR Surveys and their physical content and implication,  
C. Gruppioni (OA-Bogna, INAF) (3h) ,  
R. Maiolino (OA-Roma, INAF) (3H) ,  
G. Rodighiero (Università Padova) (3h)

-Session IV: Spectroscopy with Herschel, L. Spinoglio (IFS-Roma, INAF)  
(2h)

-Session V: Modelling galaxies in the IR, L. Piovan (Università Padova)  
(2h)

-Session VI: Future IR Sub millimeter observations; ALMA, P. Andreani  
(ESO) (2h)

### ***Practical information***

All details about the school site and organization are given in the web page  
[www.astro.unipd.it/ScuolaNazionale2010](http://www.astro.unipd.it/ScuolaNazionale2010) .

The registration fee is 380,00 euros inclusive of full board lodging at the  
“Hotel Paradiso” (double room), coffee breaks, and bus transportation  
from the Padova train station to Asiago on Sunday 24 October (the time  
table will be provided in due time) and return from Asiago to the Padova  
train station on Saturday 30 October. Students are expected to arrive to  
Asiago on Sunday 24 October in the afternoon or evening.

For more information and preliminary registration send an email to:  
[scuolaasiago2010.astronomia@unipd.it](mailto:scuolaasiago2010.astronomia@unipd.it)

Finally, I would like to remind here is that, owing to logistic reasons, the  
maximum number of students is strictly limited to 100.

Cesare Chiosi  
(Local Coordinator)

Padova, 18 June 2010

Cesare Chiosi, Dipartimento di Astronomia, Vicolo Osservatorio 3, 35122  
Padova, Italia --- Tel. 049 8278220

## PRELIMINARY REGISTRATION

To be filled up and sent by email to

[scuolaasiago2010.astronomia@unipd.it](mailto:scuolaasiago2010.astronomia@unipd.it)

or fax to

(+39) 049 827 8212 to the attention of Prof. C. Chiosi

First Name.....

Family Name.....

Sex.....

Institution.....

Address.....

Telephone.....

Email.....

I prefer to share the room with .....

Special request and/or needs.....

Note: The final registration and payment of the fee must be made through the portal in the website at the following address

[www.astro.unipd.it/ScuolaNazionale2010](http://www.astro.unipd.it/ScuolaNazionale2010)

Date.....