

## Friday 10

09:30 h | GNC for rendezvous and close proximity operations

**Murray Kerr**

Head of the Guidance, Navigation and Control Division,  
Elecnor Deimos (Spain)

10:30 h | GNC challenges in ADR with contact methods

**Murray Kerr**

11:30 h | Asteroid Retrieval Opportunities, the case of 2006 RH120

**Hodei Urrutxua**

Research Fellow, Space Dynamics Group  
Universidad Politécnica de Madrid (Spain)

12:30 h | Ballistic Capture of asteroids in Earth Orbit

**Francesco Toppato**

Assistant Professor (at Politecnico di Milano)  
Partner and founder (at Dinamica Srl) (Italy)

13:00 h | Close up

The problem of reducing the accumulation of Space Debris in Earth Orbit and the protection of Earth against the impact of threatening asteroids are among the most important topics of aerospace engineering and space technology today. Defunct manmade space objects orbiting the Earth need to be actively removed from crowded orbital regions to prevent impacts with other satellites. Similarly, asteroids that are found to be in collision course with the Earth may need to be actively manipulated to change their trajectory and prevent them from striking our planet. These kinds of space objects manipulations are technologically complex and require similar advances in guidance navigation and control, the development of several types of deflection methods and the management of uncertainties in the deflection process.

The school, as part of the European Community funded STARDUST Training Network will contain a number of talks and seminars devoted to these technological challenges. The school will provide the students with a series of lectures on proximity operations in space, deflection and deorbiting methods and advanced techniques to model and control deflection uncertainties. All lectures will be given by world experts on the subject.

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### INFORMACIÓN GENERAL

→ Hasta el 12 de junio de 2015

#### Santander

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Avda. de los Castros, 42  
39005 Santander  
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28040 Madrid  
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alumnos@uimp.es

#### Horario

de 9:00 a 14:00 h  
de 16:00 a 18:00 h (excepto viernes)

→ A partir del 15 de junio de 2015

#### Santander

Palacio de la Magdalena  
39005 Santander  
Tel. 942 29 88 00 / 942 29 88 10  
Fax 942 29 88 20

#### Horario

de 9:00 a 14:00 h  
de 15:30 a 18:00 h (excepto viernes)

### PLAZOS

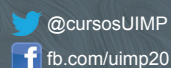
→ Plazo de solicitud de becas

Hasta el día 18 de mayo, para los cursos que comiencen antes del 17 de julio de 2015

→ Apertura de matrícula

Desde el 8 de abril de 2015 (Plazas limitadas)

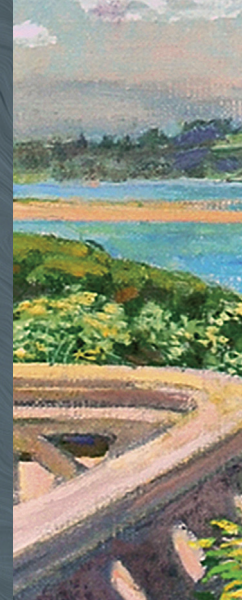
Hasta el día 15 de junio, para los cursos que comiencen a partir del día 20 de julio de 2015



Transporte oficial



→ Código 62M7 | Tarifa: A | ECTS: 1



# UIMP

Universidad Internacional  
Menéndez Pelayo

## Santander 2015

SEMINAR

## Science and Technology Challenges of Space Debris Removal and Asteroid Deflection

**Claudio Bombardelli**  
**Juan Luis Cano González**

Santander

Del 6 al 10 de julio de 2015

[www.uimp.es](http://www.uimp.es)

Sponsor



STARDUST  
PUSHING THE BOUNDARIES OF  
SPACE RESEARCH TO SAVE OUR FUTURE



## Science and Technology Challenges of Space Debris Removal and Asteroid Deflection

### Directors

**Claudio Bombardelli**

Research Associate, Space Dynamics Group  
Universidad Politécnica de Madrid (Spain)

**Juan Luis Cano González**

Head of the Mission Analysis and Navigation Division,  
Elecnor Deimos (Spain)

### July 6-10, 2015

#### Monday 6

10:00 h | Inauguration

10:30 h | Asteroid deflection: overview and ESA activities

**Andrés Gálvez**

Head of the Science Simulation and Systems Support Unit,  
European Space Agency, Headquarters (ESA / HQ), (France)

11:30 h | Deflecting asteroids with a Kinetic impactor

**Juan Luis Cano González**

12:30 h | The ion beam shepherd concept for asteroid deflection

**Claudio Bombardelli**

15:30 h | Nuclear Asteroid Deflection

**Catherine S. Plesko**

Research Scientist  
Applied Physics, Theoretical Design Division  
Los Alamos National Laboratory (EE.UU.)

16:00 h | Round table on Near Earth Asteroid mitigation

**Andrés Gálvez**

**Catherine S. Plesko**

Moderated

**Claudio Bombardelli**

**Juan Luis Cano González**

17:00 h | WG presentations / ESR- ER presentations

19:00 h | El reto de descubrir asteroides  
(Conferencia abierta al público)

**Jaime Nomen Torres**

Observatory Manager for the Deimos Sky Survey,  
Elecnor Deimos (Spain)

#### Tuesday 7

09:30 h | The space debris problem: overview and ESA activities

**Holger Krag**

Head of the Space Debris Office, European Space Agency,  
European Space Operations Centre, (ESA / ESOC) (Germany)

10:30 h | The space debris problem: main technology challenges

**Holger Krag**

11:30 h | Deorbiting space debris with drag/solar sails

**Andrew Viquerat**

Lecturer  
Mechanical Engineering Sciences  
Faculty of Engineering and Physical Sciences  
University of Surrey (United Kingdom)

12:30 h | Removing space debris with ions beams

**Claudio Bombardelli**

15:00 h | From Space Debris observation to cataloguing

**Noelia Sánchez Ortiz**

Head of Space Situational Awareness Division,  
Elecnor Deimos (Spain)

16:00 h | Round table on Space Debris

**Andrew Viquerat**

**Holger Krag**

Moderated

**Claudio Bombardelli**

**Noelia Sánchez Ortiz**

17:00 h | WG presentations / ESR- ER presentations

#### Wednesday 8

09:30 h | Fundamental of Space Robotics part 1

**José de Gea Fernández**

Senior Researcher. Team Leader «Intelligent Kinematics» DFKI  
German Research Center for Artificial Intelligence,  
Robotics Innovation Center (Germany)

10:30 h | Fundamental of Space Robotics part 2

**José de Gea Fernández**

11:30 h | The DEOS mission: status and future development

**Detlef Reintsema**

DEOS Mission Project Manager  
German Aerospace Center DLR (Germany)

12:30 h | Collision Monitoring and Avoidance

**Noelia Sánchez Ortiz**

15:00 h | Managing Uncertainties with Differential Algebra:  
Application to space Debris and Asteroids

**Pierluigi di Lizia**

Senior partner at Dinamica Srl  
Assistant Professor at Politecnico di Milano (Italy)

15:30 h | Tutorial Lecture on Differential Algebra

**Pierluigi di Lizia**

17:00 h | Network meeting

#### Thursday 9

09:30 h | Asteroid Deflection with lasers

**Massimiliano Vasile**

Professor of Space Systems Engineering  
Director of the Advanced Space Concepts Laboratory  
Department of Mechanical & Aerospace Engineering  
University of Strathclyde (United Kingdom)

10:30 h | Space debris mitigation with lasers

**Massimiliano Vasile**

11:30 h | Electrodynamics Tethers Fundamentals

**Gonzalo Sánchez Arriaga**

Assistant Professor  
Grupo de Investigación en Ingeniería Aeroespacial  
Universidad Carlos III, Madrid (Spain)

12:30 h | End of life disposal of spacecraft with  
Electrodynamics Tethers

**Gonzalo Sánchez Arriaga**

15:00 h | Environment criticality of LEO Objects

**Elisa Maria Alessi**

Research Fellow, Istituto di Fisica Applicata «Nello Carrara»  
Consiglio Nazionale delle Ricerche (Italy)

16:00 h | Space debris and asteroid activities by European  
industries. Informative Session

17:00 h | WG presentations / ESR- ER presentations

19:00 h | Operaciones de proximidad en órbita: la visión del  
astronauta (Conferencia abierta al público)

**Pedro Duque Duque**

Astronauta ESA