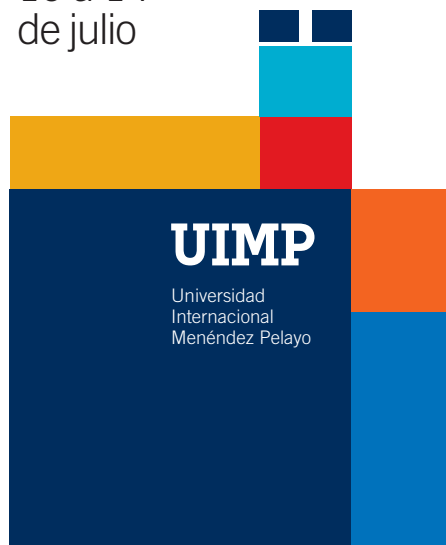


Cursos  
de verano  
**Santander**  
23

10 a 14  
de julio



**UIMP**

Universidad  
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Menéndez Pelayo

ENCUENTROS

XIX INTERNATIONAL  
SCHOOL OF  
ASTROBIOLOGY  
"JOSEP COMAS I  
SOLÀ"

Searching for  
Life on  
Ocean Worlds

### Horario y dirección de contacto

Mañana de L a V: 9.00 a 14.00 h

#### Santander

Campus de Las Llamas Avda. de  
Los Castros, 42 39005 Santander  
Tlf.: 942 29 87 00

#### Madrid

Calle Isaac Peral, 23 28040 Madrid  
Tlf.: 91 592 06 31 / 33

### A partir del 19 de junio

Mañana de L a V: 9.00 a 14.00 h

Tarde de L a J: 15.30 a 18.00 h

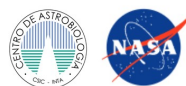
#### Santander

Palacio de la Magdalena 39005  
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Organizado:



Patrocinio



Colaboración:



Este curso es susceptible de ser reconocido como formación permanente del profesorado para el personal docente de los centros que imparten las enseñanzas reguladas en la Ley Orgánica 2/2006, de Educación, en base al artículo 21 y 29 de la Orden EDU/2886/2011, de 20 de octubre, por la que se regula la convocatoria, reconocimiento, certificación y registro de las actividades de formación permanente del profesorado.

Código 65ei - ETCS: 2,5

### Directors

Rosalyn M Lopes

Jet Propulsion Laboratory (JPL) NASA, USA

Víctor Parro García

Centro de Astrobiología (CAB) CSIC-INTA, Spain

### Organization

Carlos Briones Llorente

Centro de Astrobiología (CAB) CSIC-INTA, Spain

The 2023 Summer School will be focused on the exploration of ocean worlds orbiting the giant planets of our solar system. Moons such as Enceladus, Europa, Ganymede, and Titan are key astrobiological targets for future exploration by both NASA and ESA missions. These moons contain global liquid water oceans underneath icy surfaces and provide a different astrobiological perspective from rocky worlds such as Mars. Recent exploration has revealed the diverse biomes in Earth's deep oceans and ice sheets and has opened up our ideas of habitability. Ocean worlds present a deep potentially habitable environments dominated by the physical processes of water and ice where alien life could exist in our Solar System.

The Cassini mission revealed water vapor plumes spewing material from the interior of Enceladus, and Titan as an organic-rich world having a methane cycle similar to the hydrological cycle on Earth, with an interior ocean that is potentially habitable. Titan is the target of NASA's Dragonfly mission, which will explore the chemistry and habitability of Titan's surface using a rotorcraft. The ocean underneath Jupiter's moon Europa was revealed by the Galileo mission and, since then, evidence for water vapor plumes spewing from its interior has been mounting. Europa is the target of NASA's Europa Clipper mission and will also be studied by ESA's JUICE mission. Ganymede, the solar system's largest moon, will be studied in details by the JUICE mission, and is also an ocean world that may harbor conditions favorable to the emergence of life. These moons, as well as other potential ocean worlds such as Neptune's moon Triton or Uranus's moon Miranda, provide a rich subject area for the study of astrobiology and how life could have evolved in their hidden oceans.

Four outstanding teachers (two American and two European), experts in the field, will show us the latest news and discoveries, what energy sources keep these worlds liquid, how life could thrive under the ice crust ocean, and what are the main technological challenges to investigate the habitability and the search for evidences of a hypothetical form of life.

Matrícula: [Solicitud online](#)





## Monday 10

- 10:00 h Welcome lectures  
Astrobiology at CAB  
**Víctor Parro**  
Astrobiology at NASA  
**Rosaly M.C. Lopes**
- 10:45 h How to participate in missions at NASA and ESA.  
**Morgan L. Cable**  
Jet Propulsion Laboratory(JPL), NASA, USA  
**Nicolas Altobelli**  
European Space Agency(ESA), Madrid, Spain  
**Rosaly M.C. Lopes**  
**Víctor Parro**
- 11:30 h Ocean worlds of the Jovian system  
**Nicolas Altobelli**
- 15:00 h Laboratory and analog field work plays a key role in mission science  
**Olga Prieto Ballesteros**  
Centro de Astrobiología (CAB), Madrid, Spain



## Tuesday 11

- 09:00 h Excursion to Altamira Museum and El Soplao caves (whole day)



## Wednesday 12

- 10:00 h Ocean worlds of the Saturn system 1: Titan  
**Shannon M. MacKenzie**  
Johns Hopkins University Applied Physics Laboratory, Maryland, USA
- 11:30 h Ocean worlds of the Saturn system 2: Enceladus  
**Morgan L. Cable**
- 15:00 h Clipper and JUICE missions to a habitable ocean world  
**Nicolas Altobelli**



## Thursday 13

- 10:00 h Dragonfly mission to Titan: Flights of exploration across a carbon-rich ocean world  
**Shannon M. MacKenzie**
- 11:30 h Enceladus mission concepts: Sampling an alien ocean without the need to dig or drill  
**Morgan L. Cable**
- 15:00 h Planetary Protection considerations for ocean worlds  
**Olga Prieto Ballesteros**
- 17:00 h Open lecture (in Spanish).  
  
La investigación astrobiológica de los satélites helados de Júpiter y Saturno  
**Olga Prieto Ballesteros**

## Friday 14

- 10:00 h Student presentations
- 11:30 h Synthesis + diplomas

