

The 2017 International Summer School in Astrobiology: Final Report

From June 25—30, 2017, students from around the world gathered in Santander, Spain for the annual international summer school on astrobiology. The theme of this year's school, *Exoplanet Habitability*, was chosen to engage students studying terrestrial exoplanet formation, interiors, atmospheres, and observations. The directors of this year's school were Miguel Mas Hesse from the Centro de Astrobiología de Madrid, and Rory Barnes from the University of Washington. The lecturers were Giada Arney, Adrian Lenardic, Don Pollacco, and Sean Raymond.

The four instructors presented two lectures each and provided some guidance to 4 teams of students on group projects. Prof. Pollacco gave lectures titled "Introduction to Exoplanets, Detection Methods, Statistics, and Expected Yields of Future Surveys" and "Methods and Limitations to the Detection of Terrestrial Exoplanets and Their Atmospheres." Prof. Lenardic's lectures were "The Diversity of Tectonic Modes" and "Plate Tectonics and Habitability". Prof. Arney' lectures were "Spectral Signatures of Habitability" and "Haze and Cloud Formation in the Solar System and Beyond." Finally, Prof. Raymond's lectures were "Planet Formation Mechanisms" and "The Diversity of Terrestrial Planet Compositions."

In addition to the formal lectures, the students were divided into 4 groups and given the following data of a hypothetical exoplanet: The stellar properties, orbital and physical properties of companion planets, and a spectrum of a potentially habitable planet taken from a future large-aperture telescope. The groups used those data, as well as information from the lectures, to interpret the data and give a mock press conference where the results were disseminated to the world. The presentations synthesized the course material and were well-delivered, striking a balance between excitement and information.

On Tuesday, the students and instructors traveled by bus to the Basque town of Zumaia, home to the impressive Zumaia flysch. This region on the north coast of Spain displays thousands of layers of the rock record and is a stunning example of the tectonic forces of Earth. Among the strata is the iridium layer identified as the result of an asteroidal impact that caused the K-Pg mass extinction, see photos. This visit was arranged by a Spanish assistant director, Carlos Briones.

On Thursday night, María Rosa Zapatero presented a public lecture "Planetas extrasolares: en busca de otras Tierras" that was attended by about 50 people. Some attendees were Spanish students of the school who probably appreciated a lecture in Spanish, even if it was at a more basic level.

A total of 36 students attended this year's school, with 22 hailing from US institutions and the remainder from Europe. After the school, all the students completed an anonymous survey of the school and the overall score was 4.42/5, which is slightly better than the typical week-long course taught at la Universidad Internacional Menéndez Pelayo of 4.2/5. The highest score for the Astrobiology School was for the role of the lecturers in the course; however the students would have preferred receiving reading material prior to the school, and, as always, improved food quality.

In summary, the 2017 summer school was a success with students from around the world engaging each other and the instructors to deepen their understanding the detection and habitability of exoplanets. The only non-food score below 4/5 was the reading material, so future iterations should provide that. The Palacio de la Magdalena is a beautiful location that has sufficient amenities for the school and cultivates a sense of community among the next generation of astrobiologists.

Rory Barnes
Co-Director
Feb 7, 2017



Giada Arney lecturing at the 2017 Santander Summer School on astrobiology.



Students traverse the Zumaia flysch near a K-Pg iridium layer.



Alvaro Giménez, director of science at ESA, stopped by the school for a brief visit.



Students presenting their group project in the Royal Hall.



Another group presentation.