PhD Course in	EARTH AND PLANETARY SCIENCES
Coordinator	Prof. Giovanna Vessia Department: Engineering and Geology Email : g.vessia@unich.it
Duration	3 years - Starting date: November 2nd 2026
Disciplines	GEOS-03/B - Geologia applicata GEOS-02/A - Paleontologia e paleoecologia 09/G2 – Bioingegneria GEOS-02/C - Geologia strutturale e tettonica 09/H1 – Sistemi di elaborazione delle informazioni 08/C1 – Design e progettazione tecnologica dell'architettura GEOS-04/B - Geofisica applicata GEOS-02/B - Geologia stratigrafica e sedimentologia 08/B2 – Scienza delle costruzioni ARCH-01/C - Civiltà dell'Italia preromana ed etruscologia PHYS-05/B - Fisica del sistema Terra, dei pianeti, dello spazio e del clima GEOS-02/C - Geologia strutturale e tettonica GEOS-04/A - Geofisica della Terra solida GEOS-03/A - Geografia fisica e geomorfologia GEOS-03/B - Geologia applicata ING-INF/01 – Elettronica PHYS-05/A - Astrophysics, Cosmology and Space Science
PhD Programme description	The PhD programme in Earth and Planetary Sciences, established within the INGENIUM European University Alliance, stems from the collaboration among the University “G. d’Annunzio” of Chieti-Pescara (UdA), Munster Technological University (MTU), Universidad de Oviedo (UNIOVI), and the University of Crete. Its aim is to train researchers capable of addressing the processes that shape the Earth and planetary bodies through digital, satellite, computational and AI-based technologies, while maintaining the central role of geological and planetary sciences. The programme promotes an integrated, quantitative and comparative approach that combines field, experimental, analytical and numerical methodologies applied to natural systems. Its goal is to understand the processes that shape surfaces, interiors, materials, resources, hazards and environments—from the microscopic scale of mineralogical reactions to the reconstruction of life, environmental and climatic changes, and planetary dynamics. Research topics include natural hazards, recycling and reuse of geological and industrial materials, environmental pollution, planetary interior structure and dynamics, evolution of life and environmental change, geology of human and robotic space exploration, planetary surfaces, regoliths, resources and terrestrial analogues, as well as the use of Earth Observation to monitor natural processes and hazards. The four universities bring together complementary expertise, maintaining continuity with classical geosciences and advancing toward innovative challenges. **UdA** contributes expertise in terrestrial and planetary geology, disaster observation through ground-based, IoT and satellite sensors, resource analysis, fossil studies, cultural

heritage monitoring, and geological interpretation of terrestrial and planetary surfaces for robotic and human exploration, site selection, trafficability and hazard assessment.

MTU provides expertise in satellite constellation modelling, orbital dynamics, data transmission, cybersecurity and data integrity, supporting the optimisation of Earth Observation data and the integration of satellite, aerial and in-situ measurements for geological, geomorphological, environmental and planetary applications.

UNIOVI contributes structural geology, terrestrial and planetary petrography, astrobiology, mapping and mineralogical characterisation of Martian and lunar regoliths, and exoplanet characterisation.

The **University of Crete** provides access to the Natural History Museum, with fossil and rock collections, and offers palaeontological collaboration on terrestrial analogues of planetary environments.

INGENIUM partners are part of the Academic Board and contribute to governance, scientific development and quality assurance of the programme. They participate in doctoral training through supervision and mentoring, courses, workshops, seminars, summer schools, international mobility and access to research infrastructures. They may also contribute to doctoral supervision through joint supervision agreements and, where appropriate, co-supervision arrangements aimed at awarding double or joint degrees. These agreements will be defined on a case-by-case basis, in accordance with the regulations of the institutions involved. Although not all partner universities provide direct financial support for the current cycle, their contribution strengthens the international, interdisciplinary and collaborative dimension of the programme and consolidates its integration within the European Higher Education and Research Area.

Research activities promote a vision of the Earth and planetary systems as interconnected natural laboratories, providing scientific foundations for resource sustainability, risk reduction, conservation of natural and cultural heritage, and space exploration. Interdisciplinary co-supervisions in engineering, computer science, architecture, aerospace and biomedical fields may be activated when functional to specific geological or planetary research questions.

Particular attention is devoted to the integration of satellite and in-situ observations, including remote and proximal sensing techniques, InSAR, multispectral imaging, laboratory imaging, geological and seismological surveys, palaeontological and geophysical investigations, to determine the origin and physical properties of geomaterials. Computed tomography and 3D morphological analysis will be employed to study extinct life forms, linking geological and biological records.

The PhD programme is conceived as an open and flexible framework capable of connecting geosciences, engineering, computer science, biology, environmental technology and data analysis, always within a structure guided by geological and planetary research questions. Complementary expertise in satellite observation, robotics, infrastructures, habitats and biometrics, materials and digital twins will enrich the programme while maintaining its geological core.

Programme Objectives

The international PhD in Earth and Planetary Sciences trains highly qualified researchers capable of addressing, in an interdisciplinary and innovative manner, the challenges related to terrestrial and planetary geology, Earth Observation, monitoring of the Earth system and natural disaster mitigation, characterisation of planetary surfaces and their resources, as well as the resilience of natural and built environments, in line with Agenda 2030, Horizon Europe and the National Research Plan. The programme maintains a clear geological identity: technological, engineering, computer-science, aerospace or biomedical skills are considered complementary and enabling, without replacing the core training in geological and planetary sciences.

Specific training objectives include:

1. Developing skills in integrating satellite and in-situ observations, remote sensing, laboratory imaging, and geological, seismological, palaeontological and geophysical investigations to characterise the origin, evolution and properties of terrestrial and planetary materials.
2. Using advanced techniques such as computed tomography and 3D morphological analysis to reconstruct the anatomy and functional evolution of extinct organisms and link geological and biological records.
3. Employing digital and satellite tools to improve data quality, transmission and interpretation for monitoring natural phenomena, hazards in inhabited environments, and terrestrial and planetary geological processes.
4. Developing interdisciplinary approaches across geosciences, engineering, biology, environmental technology, materials science and data analysis, with geosciences guiding interpretation and other disciplines supporting characterisation, modelling, monitoring and management of terrestrial and planetary systems.
5. Advancing modelling and simulation of satellite constellations, orbital dynamics, data transmission and signal latency, with reference to the production, management and validation of data relevant to Earth Observation, planetary geology and hazard monitoring.
6. Understanding communication and management of information flows between satellites, ground stations and sensors to ensure efficiency and continuity of observation networks applied to geological, environmental and planetary problems.
7. Addressing cybersecurity and data integrity through anomaly detection, error protection and tampering prevention, with attention to the reliability of geospatial, geological and environmental data used in scientific interpretations and operational decisions.
8. Optimising Earth Observation data flows by integrating satellite, aerial and in-situ measurements for geological, geomorphological, environmental, hydrogeological and planetary mapping.

	9. Analysing the evolution of past ocean ecosystems through integrated palaeontological and geological datasets. 10. Studying seismogenic faults and the evolution of Plio-Pleistocene basins in the Mediterranean using integrated approaches for seismic hazard and environmental change. 11. Developing next-generation seismotectonic models integrating seismogenic processes, active faults and advanced seismological, geodetic and multidisciplinary observations. 12. Analysing instability effects caused by high-energy earthquakes and floods using satellite data. 13. Characterising the mechanical behaviour of rocks and planetary analogues through laboratory tests, field tests and imaging. 14. Developing expertise in the geology of human and robotic space exploration, including site selection, trafficability, resource mapping, regolith characterisation, risk assessment and planning of surface infrastructures. 15. Understanding the role of geosciences in ISRU, in the design of planetary analogues, in the evaluation of local materials and in defining geological constraints for habitats, landing pads, rover routes, robotic systems and support infrastructures for exploration. 16. Selectively fostering interaction with engineering, architectural, aerospace, computer-science and biomedical expertise when necessary to address complex geological problems related to Earth Observation, planetary exploration, habitat protection and sustainability of future human and robotic activities in space.
Visiting period abroad	A mandatory international visiting period of at least 6 months is required. In the case of a scholarship funded by MTU, or if applying for a double degree, the mandatory international visiting period must be at least 12 months.
PhD Website	https://www.scuolasuperiore.unich.it/offerta-formativa; https://www.ingeo.unich.it/home-earth-and-planetary-sciences-33591
Available positions	**n. 4 positions** of which:
	n. 2 positions funded by **MTU** (double degree)
	n. 1 position funded by **UdA**
	n. 1 position co-financed by the University **UdA** and **Goinfoteam** on the topic: “Blue Intelligence from Space: AI-Enabled Earth Observation for Ocean Monitoring and Sustainable Marine Resources”
Admission requirements	See art. 2 PhD Call 42nd cycle - Academic Year 2026/2027.

	Where enrolment at a partner institution is required (e.g. for joint or double degree pathways), applicants must also satisfy the admission requirements and enrolment regulations of all participating universities. All Master's degree qualifications are admitted, provided that the candidate's academic background meets the skill requirements set out in the PhD programme objectives above.
Language	English language knowledge is required
Date publication pre-Selection	**September 14th, 2026**
Exam date	The oral exam will take place **on-line** on **September 17th, 2026.** All Candidates to take the oral exam remotely will be contacted via email by the Commission to define the procedures for carrying out the test.