

**Ph.D. in Information Technology
Thesis Defense**

**October 31st, 2024
at 10:00 a.m.
Room Alpha**

Beatrice RUZZANTE – XXXVI Cycle

**UNVEILING THE PROMISE OF MOLECULAR COMMUNICATION: FROM THEORY
TO PRACTICE**

Supervisor: Prof. Maurizio Magarini

Abstract:

Molecular Communication (MC) represents a novel paradigm shift in telecommunication sciences, offering unique advantages and opportunities across diverse domains. MC harnesses the natural language of biological systems, composed of intricate signaling pathways and molecular interactions, to reproduce and analyze communication systems where information transmission relies on the transport of molecules/particles from transmitters to receivers. From its inception, MC has stood as a highly interdisciplinary field, relying on the cooperation of physicists, information/electronic engineers, biologists, biotechnologists, and bioengineers. Unfortunately, achieving such collaboration has proven challenging, as to date, MC is primarily known among telecommunication scientists. This facet underpins the lack of proof for possible practical applications of MC theory. In this dissertation, the primary attempt is to chart a course to unlock the full potential of MC theory by i) elucidating its theoretical foundations, ii) exploring novel computational approaches, iii) integrating biological insights, and iv) finally showcasing two real-world applications in the fields of environmental engineering and biotechnology. The ultimate goal is to transform MC from a theoretical concept into a practical reality with far-reaching implications for science, engineering, and medicine.

PhD Committee

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Prof. Werner Haselmayr, **Johannes Kepler University Linz**

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