

## PhD in Information and Communication Technology for Health

### Università degli Studi di Napoli Federico II

#### Module Title: Thermoplasmonic – Theory, Simulations and Biomedical Applications

**Lecturer: Fayyaz Kashif, PhD**

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**CV:** Fayyaz Kashif is an Assistant Professor (RTDA) at the University of Naples Federico II since April 2024. He earned his Ph.D. in Electrical and Information Engineering from the Polytechnic University of Bari (Italy) in 2022, focusing on the design and characterization of nanophotonic and plasmonic devices. He later worked as a postdoctoral researcher at the Centre for Biomolecular Nanotechnologies of the Italian Institute of Technology (IIT) in Lecce, where he specialized in numerical modeling, fabrication, and characterization of nanophotonic and plasmonic devices for biomedical applications. His research interests include the numerical design and characterization of nanophotonic devices for biomedical use, as well as the development of reconfigurable intelligent surfaces (RIS) at THz frequencies for 5G and 6G telecommunication networks.

**Credits:** 3 CFU/ECTS

**Overview:** This course provides an overview of the biomedical applications of plasmonic nanostructures, with a particular focus on thermoplasmonics—an emerging field that harnesses localized surface plasmon resonance (LSPR) to generate heat at the nanoscale. It covers the fundamental principles of plasmonics, along with the optical and thermal properties of metallic nanostructures. Students will gain essential knowledge and insights into the simulation, fabrication, and characterization of plasmonic nanostructures for sensing and plasmonic heating applications.

## TEACHING MODULE Announcement

### Dates and Locations (via Claudio 21, Napoli)

Date	Hours	Room	Lecturer
17 JUN 2025	10:00 – 13:00	CL-I-6	Fayyaz Kashif
19 JUN 2025	10:00 – 13:00	CL-I-6	Fayyaz Kashif
24 JUN 2025	10:00 – 13:00	CL-I-6	Fayyaz Kashif
26 JUN 2025	10:00 – 13:00	CL-I-6	Fayyaz Kashif

### Contents:

**Lecture 1** – Introduction to plasmonics: The fundamental concepts and theory of the plasmonics will be introduced. A general overview of the applications of the plasmonic phenomenon will be given.

**Lecture 2** – Thermoplasmonics: An introduction to thermodynamics of metal nanoparticles will be given. An overview of the mechanisms and governing equations will be provided.

**Lecture 3** – Numerical simulation techniques: In this lecture, numerical tools will be described to determine the temperature distribution in arbitrary complex plasmonic systems.

**Lecture 4** – Applications: This lecture will be dedicated to state of art on the topic of thermoplasmonics. Based on the interest of the students, I would invite an expert for a seminar.

### Notes

The course will be held in English. The doctoral students interested in this course are requested to send me an e-mail mentioning their names and PhD cycle.

The course is conducted on site. However, students pursuing their PhD period abroad (for research purposes) have the option to request remote attendance class via MS Teams.

[https://teams.microsoft.com/l/meetup-join/19%3ameeting\\_ZDQxMGI1YTEtNTVkMy00ZmVmLWl0MmEtYmI2OWYxNWQ1ZGZk%40thread.v2/0?context=%7b%22Tid%22%3a%222fcfe26a-bb62-46b0-b1e3-28f9da0c45fd%22%2c%22Oid%22%3a%2211489278-f984-4ea4-8bfc-94e39efc3891%22%7d](https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZDQxMGI1YTEtNTVkMy00ZmVmLWl0MmEtYmI2OWYxNWQ1ZGZk%40thread.v2/0?context=%7b%22Tid%22%3a%222fcfe26a-bb62-46b0-b1e3-28f9da0c45fd%22%2c%22Oid%22%3a%2211489278-f984-4ea4-8bfc-94e39efc3891%22%7d)

There will be a final assessment, provided in two different modalities: students can choose to simulate a problem using computational software such as COMSOL, or can choose to take an oral exam on the topics covered during the course.