# Master (M2) Internship *(6 months)*

## Tunable Huygens Metasurface – Application to antenna design

### Context and objectives

A new generation of material called metamaterials has been extensively investigated since last few years. It has raised a great interest in the scientific community due to their huge potential of applications. Metamaterials are artificial engineered materials which exhibit very promising properties not readily available in nature. One major field of applications is related to telecommunications in both optical and microwave ranges.

The topic of the internship is related to antenna applications. Metamaterials have been found to be helpful in order to improve antenna performances. They are frequently used in a slab form, also called metasurfaces. Combined with traditional antennas, these metasurfaces can enhance radiation properties. Several types of metasurfaces exist. Among them, Huygens' metasurfaces have demonstrated unprecedented capabilities of controlling electromagnetic wavefronts by means of electric and magnetic dipole moments. With an appropriate command, the metasurface would be tuned in such a way that the desired property is achieved at the targeted frequency.

So the **objective of the internship** is to **design a tunable Huygens metasurface** which will be used **for antenna applications**. The tunability could be introduced with active electronic elements.

**Telecom Paris** is a recognized institute in this field of research and the selected student will benefit of the experience of several scientists working together in antennas and metasurfaces. All required tools for simulations and measurements are available at Telecom Paris.

### Proposed tasks

- To draw a state of the art of Huygens metasurfaces and to identify most promising structures
- Design of a new Huygens tunable metasurface
- To fabricate and to measure the proposed tunable metasurface

### Required knowledge

The student should have strong background in electromagnetic theory and antenna design. Good knowledge of electromagnetic simulation software (such as CST Studio Suite or Ansys HFSS) as well as microwave measurements would be appreciated too.

### Contacts

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