Metamaterials and Plasmonics:
Cloaking, Negative Index and Other Applications

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The quest for miniaturizing and optimizing the performance of electromagnetic devices for numerous applications (e.g., wireless and optical communications, imaging) has fostered in recent years a strong interest in artificial materials, metamaterials and plasmonics, whose exciting and anomalous electromagnetic properties may overcome certain limitations of the current technologies at various frequencies, from microwaves to THz, infrared and optical frequencies. Among the most striking properties of these materials, we can cite the possibility of drastically reducing the visibility (electromagnetic scattering) of an object, negative index of refraction, ultracompact resonances, slow-wave propagation and supercoupling.

In this talk, I will provide an overview of our findings in these various fields of research, employing metamaterials and plasmonic layers to envision efficient cloaks, negative-index materials and various other exciting applications. After giving an overview of the current state of the art in the fields of metamaterials and plasmonics, I will show how these concepts may overcome some current technological limitations and provide a breakthrough in various applied fields. I will discuss several potential applications, from camouflaging and scattering reduction to non-invasive probing and efficient energy extraction, imaging and waveguiding, spanning frequencies that go from the microwaves to the visible.