**Designing Thermoplasmonic Gold Nanoparticles for Cancer Theranostics**

The use of gold nanoparticles in cancer therapy and diagnosis (e.g. photothermal therapy, photoacoustic imaging) is currently being developed as a minimally invasive technique. By tuning the local surface-plasmon resonance frequency of the gold nanoparticle through its design parameters to a particular biological transparency window, the optical response of the nanoparticle and hence its functionalities can be enhanced greatly. With the contemporary fabrication techniques, nanoparticles in diverse shapes and sizes become accessible. Additionally, two biological transparency windows in the infrared regime have  been established in the last two years. Thus, laying out key design elements and scaling properties of nanoparticles may provide a better start for future implementations across different windows.

In this talk, the optical response of basic solid (sphere, disk, rod) and hollow (shell, ring, tube) nanoparticle shapes are compared in the present biological transparency windows, based on electromagnetic simulations. These nanoparticle shapes are selected intentionally as they are readily available by chemical fabrication techniques. We demonstrate how the hollow geometry provides scattering suppression and absorption enhancement along with a red-shift of the local surface-plasmon resonance, thereby providing an important advantage at biological transparency windows of longer wavelengths. The optical performance of nanoparticle designs is evaluated under several benchmarks that are relevant to the application environment, such as nanoparticle size which effects cellular intrusion and retension, nanoparticle mass which correlates with cytotoxicity.

Currently, conventional photothermal therapy/diagnosis is being challenged by synergistic approaches based on simultaneous utilization of multiple therapeutic schemes (e.g. chemotherapy, photodynamic therapy) and imaging modalities (optical/thermal/acoustic) on the same nanoparticle platform. We also address this perspective towards  achieving multifunctional nanoparticle designs

**Short Bio:** Kaan Güven took his Ph.D from Department of Physics, Bilkent University in 1999. He worked as a post-doc in Prof. Klaus von Klitzing’s group at Max-Planck Institut in Stuttgart and then as a research associate in Nanotechnology Research Center at Bilkent University. In 2009 he joined the department of physics at Koç University. His currently involved with experimental and computational research on microwave metamaterials, plasmonics and nanophotonics.