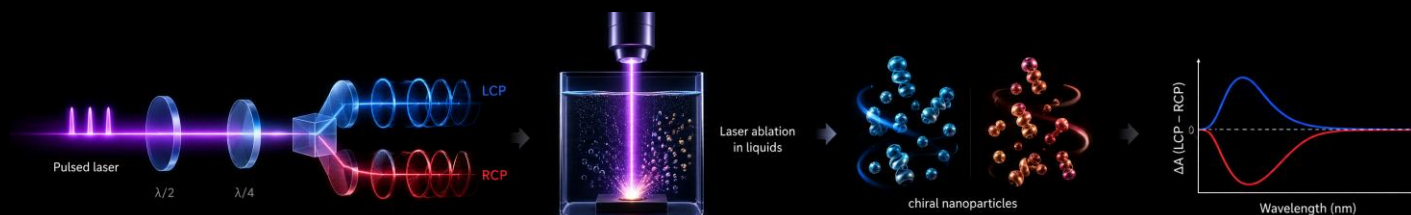


## Master Thesis Project

### Writing chirality with light: Generating chiral nanoparticles with circularly polarized light

Can the handedness of circularly polarized light be transferred to nanoparticles during laser ablation in liquids?



**Research area:** Nanomaterials | Light-Matter Interactions | Chirality | Optical Spectroscopy

**Scientific motivation:** Light can do more than probe matter — it can also drive chemical transformations and influence how materials form. Circularly polarized light carries a defined handedness, raising a fascinating question: can this optical handedness be transferred into the structure of a material? Nanoparticle formation provides an ideal platform to investigate this concept. If the handedness of the incident light influences nucleation, growth, or assembly, it may become possible to generate chiral nanostructures without relying exclusively on chiral molecular templates. Understanding such light-driven symmetry breaking would provide new insight into the interaction between electromagnetic fields and matter, while opening potential routes toward optically programmable nanomaterials.

**Research question:** Can the handedness of circularly polarized light direct the formation and optical activity of chiral nanoparticles?

**Your project and the skills you will develop:** In this Master thesis, you will investigate whether controlled illumination can influence symmetry during nanoparticle formation and generate measurable chiroptical properties.

During your thesis, you will:

- Prepare nanoparticles under well-defined irradiation conditions using circularly polarized light
- Systematically vary experimental parameters such as irradiation time, wavelength, and synthesis conditions
- Characterize the resulting nanoparticles using optical and structural methods
- Determine whether the handedness of the illumination produces reproducible materials
- Correlate nanoparticle structure, morphology, and optical response
- Develop experience in experimental design, quantitative spectroscopy, and critical interpretation

You will gain hands-on experience with techniques including:

- Nanoparticle synthesis and colloidal characterization
- Circular dichroism (CD) spectroscopy
- Dynamic Light Scattering (DLS)
- Structural and microscopic characterization
- Polarization optics and laser ablation

The project offers the opportunity to work with advanced experimental methods at the interface of physical chemistry, materials science, and optical physics and is suitable for students in **Chemistry** | **Physics** | **Materials Science**. Previous experience in spectroscopy or materials synthesis is helpful but not required. An interest in interdisciplinary experimental work and careful quantitative measurements is particularly valuable.

**Interested? For more information contact:** PD. Dr. Aras Kartouzian | [aras.kartouzian@tum.de](mailto:aras.kartouzian@tum.de)