Abbe School of Photonics | JENA
Friedrich-Schiller-Universität

PhD position in the subject area of "Chiral structured-illumination microscopy: fast imaging chiral domains with sub-wavelength resolution"

[Motivation] Being able to clearly "see" the spatial distribution of molecular chiral domains at high resolution would provide important spatial-conformational information of the sample. So far, fast imaging of chiral domains at sub-wavelength resolution is still challenging. Recently, we have theoretically proposed a new imaging modality, "chiral structured-illumination microscopy (Chiral SIM)", to fast image fulorescent molecular chiral domains at sub-wavelength resolution. **[Goal]** This project aims at demonstrating a proof-of-concept experiment of the proposed Chiral SIM method. We will show the fast imaging of chiral domains in biological and chiral polymer samples with sub-wavelength spatial resolution and unambiguous chirality identification. After proving the concept, we aill move to structured-surface assisted chiral imaging. Nano 3D printer will be used to create the structured suface for optial chirality enhancement. **[Significance]** Chiral SIM may help us to unravel the complex origins of misfolded proteins and advance the understanding of sub-cellular protein dynamics. Potential applications are in molecular biology, pathology, pharmaceutical industry and material sciences. **[Status]** The theory of the chiral SIM method has been developed and published [Ref. 1]. The optical setup for chiral SIM is immediately available. Experimental demonstration is in progress. We look for motivated students who are interested in learning state-of-the-art super-resolution microscopy, nanooptics, and chiral light-matter interactions to join this project.

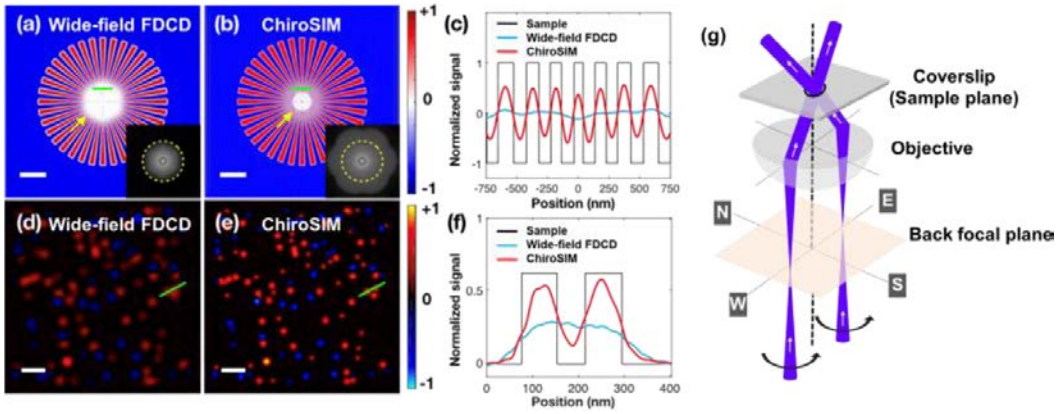

Figure 1. Using chiral SIM to image the molecular chiral domains at a sub-wavelength resolution. (a-c) chiral Siemens star and (d-f) randomly distributed chiral beads. Scale bar: 1 µm. (g) One possible experimental scheme for chiral SIM.

PhD position requirements

Applications are invited for PhD candidates with a good understanding of physical chemistry and microscopy. Proven research abilities to work both, independently and cooperatively with others, are highly desirable. Good English communication skills (including oral presentation and writing) are a must. Additional skills in software for 3D computer graphics (Blender, 3ds Max, etc.), programming (LabView, Matlab), and data analysis (Origin) are a plus. Hands-on experiences in fluorescence microscopy, polarization microscopy, and FDTD simulations is highly desirable.

Your qualifications:

- Master's degree in chemistry, physics, optics, photonics, or a related discipline
- Background knowledge in physical chemistry (fluorescence) and photonics (microscopy)
- Very good communication skills in written and spoken English

Supervisor: Dr. Jer-Shing Huang, Leibniz Institute of Photonic Technology
Co-Supervisor: Prof. Dr. Rainer Heintzman, Institute of Physical Chemistry, FSU

Further information

Website: https://www.leibniz-ipht.de/en/research/departments/nanooptics/overview.html and http://goo.gl/Tz0MXx. Contact: jer-shing.huang@leibniz-ipht.de

Ref. 1. S.-Y. Huang, J. Zhang, C. Karras, R. Förster, R. Heintzmann, J.-S. Huang "Chiral Structured Illumination Microscopy" *ACS Photonics* **2020**, in press. See also arXiv:1908.09391.