Carl Zeiss Stiftung

HONORARY GUEST LECTURE

A lecture series offered by the Jena Alliance "Life in Focus"

ACP/ASP Guest Professor

PROF. MARKUS SAUER

Julius-Maximilians-University Würzburg

Markus Sauer studied Chemistry at the University Heidelberg where he received his Diploma in 1991 and his PhD in 1995 in Physical Chemistry. 1998 he has been awarded the BioFuture Prize for Detection, Analysis and Handling of Single Molecules, which allowed him to establish his own group for single-molecule fluorescence detection and single-molecule DNA sequencing. From 2003-2009 he was Professor and chair of Laser Physics and Laser Spectroscopy at the University Bielefeld, Germany. Since 2009 he is Professor and Chair of the Department of Biotechnology and Biophysics at the Julius Maximilian University Würzburg, Germany. His research interests are single-molecule fluorescence spectroscopy and imaging with a particular focus on super-resolution fluorescence imaging by *direct* stochastic optical reconstruction microscopy (*d*STORM) and its applications in neurobiology and immunology. He has published more than 300 papers and coordinates several super-resolution microscopy projects.

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MOLECULAR RESOLUTION FLUORESCENCE IMAGING (PROF. MARKUS SAUER)

Tuesday, April 18, 2 pm
ACP Auditorium, Albert-Einstein-Straße 6, 07745 Jena
Zoom-Meeting-ID: 641 4598 7220, Kenncode: 648685

In the last decade, super-resolution microscopy has evolved as a very powerful method for sub-diffraction resolution fluorescence imaging of cells and structural investigations of cellular organelles. Super-resolution microscopy methods can now provide a spatial resolution that is well below the diffraction limit of light microscopy, enabling invaluable insights into the spatial organization of proteins in biological samples. However, current super-resolution measurements become error-prone below 25 nm. In addition, refined single-molecule localization microscopy methods achieved localization precisions of only a few nanometers, but here too, translation of such high localization precisions into sub-10 nm spatial resolution in biological samples remains challenging. In my contribution I will discuss two possibilities to bypass these limitations. One is based on physical expansion of the cellular structure by linking a protein of interest into a dense, cross-linked network of a swellable polyelectrolyte hydrogel. Since its first introduction by Boyden and co-workers in 2015, expansion microscopy (ExM) has shown impressive results including the magnified visualization of pre- or post-expansion labeled proteins and RNAs with fluorescent proteins, antibodies, and oligonucleotides, respectively, in cells, tissues, and human clinical specimen. By combining ExM with super-resolution microscopy it is potentially possible to enable multicolor molecular resolution fluorescence imaging. The other approach uses resonance energy transfer between fluorophores separated by less than 10 nm and reveals interfluorophore distance information from time-resolved fluorescence detection in combination with photoswitching fingerprint analysis. We will show how the two methods can be used advantageously in combination with genetic code expansion (GCE) with unnatural amino acids and bioorthogonal click-labeling with small fluorophores for true molecular resolution fluorescence imaging.

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