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Prof. Dr. Wolters received the diploma degree in Mathematics with a minor in Medicine from the RWTH Aachen, Aachen, Germany, the Ph.D. degree in Mathematics from the University of Leipzig, Leipzig, Germany and the Habilitation in Mathematics from the University of Münster, Münster, Germany, in 1997, 2003 and 2008, respectively. From 1997 to 2004, he was with the Max Planck Institutes for Human Cognitive and Brain Sciences and Mathematics in the Sciences, Leipzig, Germany. From 01/2004 to 02/2005, he joined the Scientific Computing and Imaging Institute at the University of Utah, Salt Lake City, USA. Since 03/2005, he is a Research Associate with the Institute for Biomagnetism and Biosignalanalysis (IBB) at the University of Münster, Münster, Germany. Since 11/2008, he is heading the research group "SIM-NEURO (Stimulation, Imaging and Modeling of NEUROnal networks in the human brain)" at the IBB. In 2017 he was awarded the title of an außerplanmäßiger Professor by the Medical Faculty of WWU.
The main research areas of the SIM-NEURO (Stimulation, Imaging and Modeling of NEUROnal networks in the human brain) research group at the IBB are the development of new methods and applications for multimodal brain imaging and brain stimulation to reconstruct and manipulate neuronal networks in the brain. Brain imaging methods include modalities such as Electroencephalography (EEG), Magnetoencephalography (MEG), Magnetic Resonance Imaging (MRI), diffusion MRI (dMRI), functional MRI (fMRI) and Positron Emmission Tomography (PET). A special focus is on the development of multimodal imaging and combined EEG/MEG/MRI source reconstruction methods using new forward (mainly finite element method based) and inverse approaches (Bayesian estimation, Kalman-filtering, spatio-temporal current density approaches, beamforming, dipole fitting and scanning techniques). In the brain stimulation research field we contribute new optimization methods for multi-sensor setups to transcranial direct and alternating current stimulation (tDCS, tACS), transcranial magnetic stimulation (TMS) and combined tCS/TMS. We develop artifact-correction, linear and non-linear registration as well as segmentation approaches for structural MRI such as T1-MRI, T2-MRI and dMRI and for PET. The new methodology is applied in the field of neuroscientific brain research and in clinical applications such as presurgical epilepsy diagnosis and schizophrenia.

Title of the lecture

New non-invasive multimodal neuroimaging and neurostimulation methods for improved diagnosis and therapy in refractory focal epilepsy

In recent years, the use of electroencephalography (EEG) and magnetoencephalography (MEG) source imaging (ESI, MSI) has gained considerable attention in presurgical epilepsy diagnosis. The source imaging is generally combined with further modalities such as video-EEG, MRI, neuropsychology and others. In my talk, I will discuss new techniques of forward and inverse modeling in ESI and MSI and especially combined E/MSI of ictal and interictal epileptic activity. I will present data on how the source analysis results are discussed and interpreted in the context of the accompanying further modalities. Case studies will be presented that enlighten the use of this multimodal diagnostic procedure in epileptology and evidence on clinical value is summarized. Finally, an accurate diagnosis enables also new therapy approaches where I will focus on non-invasive targeted and optimized multi-channel transcranial electric stimulation.