Dresden University of Technology

Faculty of Physics

PHYSICS COLLOQUIUM

Speaker: **Prof. Matthias Eschrig**
Institute of Physics
University of Greifswald

Topic: **Geometric Phases and Superconducting Diode Effect**

Time and place: Tuesday, October 28, 2025, **2:50 pm** – hybrid event
The colloquium will be held in REC/C213.
Online participation possible:
Zoom-Meeting: Meeting-ID: 631 3817 8900 / passcode: PC-WiSe25
https://tu-dresden.zoom-x.de/j/63138178900?pwd=TlmGawPz1dtDA6VzO2N1XdqqI7bE6b.1

Host: Prof. Carsten Timm

Abstract: Superconducting spintronics is based on spin-polarized Cooper pairs, which appear near the interfaces between superconducting and magnetic materials. In the case of a Josephson device containing a strongly spin-polarized itinerant ferromagnet, only Cooper pairs with equal spin relative to the spin quantisation axis contribute over appreciable distances. Typically, the conversion process from spin-singlet to equal-spin pairs requires *non-collinear* magnetic inhomogeneities in the vicinity of the interface. If the spin texture in the Josephson junction is also *non-coplanar*, a distinctive Josephson Diode Effect appears. This effect is driven by spin-geometric phases that enter the current-phase relation in a novel way. In the case of a spatially slowly varying magnetization profile, they enter via an effective U(1) gauge field that couples with opposite sign to the two spin projections. This opens up the field to an entire new set of phenomena related to the interplay between spin-geometric phases and Josephson phases. I present an overview over these novel functionalities.

Bio: Matthias Eschrig studied Physics at the Universities of Leipzig and Bayreuth, and completed his Ph.D. at the University of Bayreuth, Germany, in 1997. After postdoctoral research in the U. S. at Northwestern University (1997-1999) and at Argonne National Laboratory (1999-2001), he moved to University of Karlsruhe (since 2009 Karlsruhe Institute of Technology) in Germany, where he stayed from 2001-2010, and where he completed his Habilitation Degree in 2005. After guest professorships at University of Konstanz in 2007 and 2009-2010, he joined the faculty at Royal Holloway, University of London in November 2010, where he was promoted to Full Professor in January 2012. In 2019, he accepted the offer of a Chair in Condensed Matter Theory at University of Greifswald.
He acted as founding member and co-director of the Hubbard Theory Consortium, as founding member of the Baltic Consortium of Theoretical Physics, as Fellow of the South East Physics Network (SEPnet), and as member of the Board of Governors of the International Institute for Complex Adaptive Matter. In 2015 he was awarded the Lars Onsager Guest Professorship and Lars Onsager Medal of the Norwegian University of Technology.