



Institut für  
Angewandte Physik



Physikalisches  
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RHEINISCHE  
FRIEDRICH-WILHELMS-UNI-  
VERSITÄT BONN

## COLLOQUIUM „OPTICS AND CONDENSED MATTER“

**Robert Smit**

*Leiden University, Netherlands*

### **Stable single emitters at the interface for quantum sensing and beyond**

Fluorescent single molecules embedded in cryogenically cooled organic host crystals provide a unique platform for exploring quantum physics at the molecular scale. Moreover, their rich energy scales for interactions, mediated by optically active electronic transitions, vibrations/phonons up to their spin degrees of freedom, offers many opportunities for coupling molecular quantum systems to other physical platforms.

However, enhancing such couplings requires bringing molecules in close proximity to these physical platforms and thus closer to surfaces or interfaces of their hosts. This presents a challenge: surfaces and interfaces often host dynamical processes that degrade spectral stability and coherence of the single molecules. In the first part of the talk, I report on our investigation of the 2D material hexagonal boron nitride (hBN) as an inorganic surface for hosting single molecules and demonstrate that it provides markedly improved spectral stability compared to molecules close to surfaces of conventional organic matrices.

In the final part of the talk, I will discuss a complementary experiment in which single emitters in diamond, possessing spin degrees of freedom, are positioned near a levitating magnet confined in a magnetic Paul trap. By maximizing the coupling between the spins and the mechanical motion of the levitated magnet, we aim not only to sense the magnet's motion, but also to exploit backaction to cool its motion.

**November 25th, starting with discussion at 17:00 h, talk at 17:15 h, live IAP lecture hall or via Zoom**

<https://uni-bonn.zoom.us/j/98441612025?pwd=a01SSjlkY1Q3SDFhL09JQk1qc1V6dz09>

Meeting-ID: 984 4161 2025

Kenncode: 294164