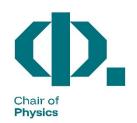


## Lehrstuhl für Physik

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## S E M I N A R on Semiconductor Physics and Nanotechnology

## **DEFENSIO:**

Fr, 21.11.2025, 14:00 Uhr,

in person in the Physics lecture hall or via Zoom

"Two-dimensional Phyllosilicates as an Air-stable Platform for Layered Magnetic Materials"

## Muhammad Zubair Khan, M.Sc.

Chair of Physics, Department Physics, Mechanics and Electrical Engineering, Technical University of Leoben, Austria

Since the discovery of graphene, intrinsic magnetic ordering in two-dimensional (2D) materials remained challenging, prompting approaches such as proximity effects, defect engineering, and doping. Intrinsic 2D ferromagnetism was first observed in chromium-based compounds, but their poor ambient stability and cryogenic ordering temperatures limit practical use.

Phyllosilicates offer a promising alternative as naturally occurring, ambient-stable layered materials that host magnetic ions via Mg substitution in the octahedral site. Studies of iron-rich phyllosilicates show that the presence of mixed Fe<sup>2+</sup>/Fe<sup>3+</sup> states enhance magnetic ordering. The visualization of magnetic domains and layer-dependent ordering in 2D phyllosilicates using scanning SQUID microscopy, reveal intrinsic A-type in-plane anti-ferromagnetic ordering.

The work also focus on the developing scalable approach to induce room-temperature ferromagnetism in phyllosilicates through broad-beam ion implantation, enabling new pathways to fabricate ambiently stable 2D magnetic insulators with tunable magnetic properties.