

Single Crystalline Epitaxial Growth of Altermagnetic Materials

Vedoucí: RNDr. Eva Schmoranzarová, Ph.D. (eva.schmoranzarova@matfyz.cuni.cz)
Katedra chemické fyziky a optiky MFF UK
Konzultant: Dr. Dominik Kriegner (kriegner@fzu.cz)
Fyzikální ústav AV ČR

Altermagnetism is a newly discovered form of magnetic order in addition to ferromagnets and antiferromagnets [1]. Effects in altermagnets are explained by particular symmetries linking the opposite magnetic sublattices [1, 2, 3] as illustrated in the left part of the figure below. These materials are attracting increasing interest due to their potential in spintronic devices, particularly when integrated into thin-film heterostructures.

This project focuses on the epitaxial growth of single crystalline altermagnetic thin films using magnetron sputtering where a plasma is used to deposit source material on a single crystalline substrate. High crystalline quality is key to unlocking the exotic properties of altermagnets, and thin films offer the most promising route toward real-world applications.

Depending on interest, the project can be extended to include structural and functional characterization of the grown films, using techniques such as X-ray diffraction, magnetotransport measurements, or electron microscopy. Basic programming knowledge is a plus, as we use automated systems to control and monitor the growth processes.

If you're curious about cutting-edge magnetism and want hands-on experience with state-of-the-art deposition techniques, this project offers a unique opportunity to get involved in forefront materials research at the Institute of Physics of the Czech Academy of Sciences.



Figure 1: (left) Sketch of the unit cell of an altermagnetic material with two opposite magnetic sublattices indicated by blue and red environment linked by rotational symmetry operation. (right) Photograph of plasma in a magnetron sputter deposition system.

References

- [1] Šmejkal, Libor, Jairo Sinova, and Tomas Jungwirth. *Physical Review X* **12**, 040501 (2024).
- [2] Gonzalez Betancourt, R. D., et al. *Physical Review Letters* **130**, 036702 (2023).
- [3] Krempaský, Juraj, et al. *Nature* **626**, 517 (2024).

