

PHYS-803

**New Trends in Chiral Magnetism (2019)**

Various lecturers

Cursus	Sem.	Type
Physics		Obl.

Language of teaching	English
Credits	2
Session	
Exam	Project report
Workload	60h
<b>Hours</b>	<b>28</b>
Courses	28
<b>Number of positions</b>	<b>36</b>

**Frequency**

Only this year

**Remark**

Only this year / MON 20.08.18 to FRI 24.08.18

**Summary**

This summer school provides expert knowledge on theory, experiments and possible applications of chiral magnetism. Timely research topics, considering e.g. chiral domain walls, spin spiral and cycloids, skyrmions, magnonic crystal properties and directional dichroism of microwaves are covered.

**Content**

The school will address experimental and theoretical physics, experimental and computational material science, microengineering and electrical engineering. The summer school will offer the students chances to communicate with researchers from both academic and industry for further career plan.

**1. Introduction:**

- a. General aspects of topology;
- b. Bulk and interfacial Dzyloshinskii-Moriya interaction;
- c. Chiral spin structures, such as chiral domain walls, spin spiral and spin cycloids, skyrmions;
- d. Topological Hall effect;
- e. Emergent electrodynamics;
- f. Spin waves;
- g. Correlated electron systems;
- h. Spin-based nanoelectronics;
- i. Skyrmion racetrack memory.

**2. Theoretical physics of chiral magnetism:**

- a. Ab-initio theory.

**3. Computational methods:**

- a. Density functional theory (DFT) calculation;
- b. Computational materials science;
- c. Micromagnetic simulations (using OMMFF and Mumax3).

**4. Materials science:**

- a. Materials growth and synthesis;
- b. Characterisation techniques of materials;
- c. Micro- and nano-engineering of magnets.

**5. Experimental techniques:**

- a. Superconducting quantum interference device (SQUID);
- b. NV-center microscopy;
- c. Cantilever magnetometry;
- d. Lorentz transmission electron microscopy (LTEM);
- e. Spin-polarized scanning transmission microscopy (SP-STM);
- f. Neutron spin echo spectroscopy, small-angle neutron scattering (SANS);

- g. Resonant elastic X-ray scattering (REXS)
  - h. Ultrafast magnetism and time resolved magneto-optic Kerr effect (MOKE);
  - i. Broadband spectroscopy of spin waves using microwave electronics;
  - j. Brillouin light scattering (BLS).
- 6. Industrial application of chiral magnetic structures**
- 7. Academic and industrial career instructions**

### Note

**MON 20.08.18 to FRI 24.08.18**

Limited to 36 participants

EPFL Professors: Prof. Dirk Grundler & Prof. Henrik M. Rønnow

EPFL PhD students: Ping Che & Anna Kúkol'ová

### Keywords

chiral magnetism, Dzyloshinskii-Moriya interaction, skyrmions, magnetization dynamics

### Resources

#### Websites

- <https://ntcm2018.epfl.ch/>