Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Hamiltonska dinamika v magnetnih nano-tekočinah**
Course title:	**Hamiltonian dynamics of magnetic nanofluids**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA		**1**. ali 2.	**1., 2. ali 3.**
PHYSICS		**1**. ali 2.	**1., 2. or 3.**

Vrsta predmeta / Course type

Izbirni za modula Biofizika 3 in Fizika 1, 2, 3

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Mentorstvo Mentorship	Samost. delo Individ. work	ECTS
10					**290**	**10**

Nosilec predmeta / Lecturer: **Victor Sokolov, Samo Kralj**

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/Slovenian
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Predznanje iz klasične in moderne fizike in iz matematične fizike

Prerequisits:

Pre-knowledge of classical physics, modern physics, and mathematical methods in physics

Vsebina:

1) Hamiltonski opis idealne tekočine
2) Hamiltonski opis idealne magnetne nano-tekočine z ravnovesno magnetizacijo
3) Hamiltonski opis idealne magnetne nano-

Content (Syllabus outline):

1) Hamiltonian description of the ideal fluid
2) Hamiltonian description of the ideal magnetic nanofluid with equilibrium magnetization

tekočine z »zamrznjeno« magnetizacijo 4) Teorija valovnega razširjanja v magnetnih nano-tekočinah. Primerjava teoretičnih in eksperimentalnih rezultatov 5) Aplikacije magnetnih nano-tekočin	3) Hamiltonian description of the ideal magnetic nanofluid with frozen-in magnetization 4) Theory of waves propagation in magnetic nanofluids. Comparison of theoretical results with experimental data 5) Applications of magnetic nanofluids

Temeljni literatura in viri / Readings:

1) R. E. Rosensweig Ferrohydrodynamics. Dover Publications, 1997.

2) P. M. Chaikin, T. C. Lubensky, Principles of Condensed Matter Physics, Cambridge University Press, Cambridge, 1995.

3) A. N. Beris, B. J. Edwards Thermodynamics of Flowing System with Internal Microstructure, Oxford University Press,Oxford,1993.

4) Blums, A. Cebers, M.M. Maiorov, Magnetic Fluids. Walter de Gruyter, Berlin, New York, 1997.

5) Ferrofluids, Magnetically Controllable Fluids and Their Applications, Editor: Odenbach S. Lect. Notes Phys. 594, Springer, Berlin, 2002.

Cilji in kompetence:	**Objectives and competences:**
Študenti pridobijo napredna znanja s področja Hamiltonskega formalizma fizike kompleksnih tekočin.	Students acquire advanced knowledge on application of Hamiltonian formalism in physics of complex fluids.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje ključnih metod Hamiltonovega formalizma. Prenesljive/ključne spretnosti in drugi atributi: Rešitev problemov z matematičnimi orodji, numeričnimi metodami, univerzalnosti v fiziki in celosten pristop k reševanju problemov	Knowledge and understanding: Understanding of key methods in Hamiltonian formalism. Transferable/Key Skills and other attributes: Solving of problems with mathematical tools, universalities in physics

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in reševanje zastavljenih problemov.	Lectures and solving of defined problems.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Dva seminarja Ustni izpit	**50%** **50%**	Two seminars Oral exam

Reference nosilca / Lecturer's references:

1) B.U. Felderhof, V.V. Sokolov, P.F. Eminov, Ferrofluid dynamics, magnetic relaxation, and irreversible thermodynamics, J. Chem. Phys. 132, 184907 (2009).
2) S. Kralj, G. Cordoyiannis, D. Jesenek, A. Zidansek, G. Lahajnar, N. Novak, H. Amenitsch, Z. Kutnjak, Dimensional crossover and scaling behavior of a smectic liquid crystal confined to controlled-pore glass matrices, Soft matter 8, 2460 (2012).
3) V.V. Sokolov, Wave propagation in magnetic nanofluids (a review). Acoustical Physics, 56, 972 (2010).
4) KRALJ, Samo, MAJUMDAR, Apala. Order reconstruction patterns in nematic liquid crystal wells. *Proceedings. Series A, Mathematical, Physical and Engineering Sciences*, ISSN 1364-5021. [Print ed.], 2014, vol. 470, no. 2169, str. 1-18. http://rspa.royalsocietypublishing.org/content/470/2169/20140276.abstract, doi: 10.1098/rspa.2014.0276. [COBISS.SI-ID 20812040]
5) V.V. Sokolov, Dynamics of nanofluids with frozen-in magnetization, 2012 Technical Proceedings of the 2012 NSTI Nanotechnology Conference, USA, Santa Clara, 420 (2012).