Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Zlom simetrije**
Course title:	**Symmetry breaking**

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
15					**435**	**15**

Nosilec predmeta / Lecturer:	**Samo Kralj**
Jeziki / Languages: **Predavanja / Lectures:**	slovenski/Slovenian
Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Predznanje iz klasične in moderne fizike in iz matematične fizike.	Pre-knowledge of classical physics, modern physics, and mathematical methods in physics.

Vsebina:	**Content (Syllabus outline):**
1) Landau-ova teorija faznih prehodov	1) Landau theory of phase transitions
2) Značilne razdalje in časovne skale	2) Characteristic lengh and time scales
3) Zlom zvezne simetrije in topološki defekti	3) Szmmetry breaking and topological defects
4) Statika in dinamiko topoloških defektov	4) Statics and dynamics of topological defects

5) Interakcija med nanodelci, koloidi in topološkimi defekti; samoorganizacija 6) Topološki defekti v bioloških membranah 7) Topološki defekti kot občutljivi detektorji	5) Interaction between nanoparticles, colloids, topological defects; selforganisation 6) Toplogical defects in biological membranes 7) Topologica defects as sensitive detectors

Temeljni literatura in viri / Readings:

1) M. Kleman, O.D. Lavrentovich, Soft Matter Physics, Springer-Verlag, New York, 2003.
2) P. M. Chaikin, T. C. Lubensky, Principles of Condensed Matter Physics, Cambridge University Press, Cambridge, 1995.
3) P.G. de Gennes, J. Prost, The Physics of Liquid Crystals, Oxford University Press,Oxford,1993.
4) A. Leach, Molecular modelling: Principles and applications, Pearson, 2001.
5) J.C. Taylor, Hidden Unity in Natural Laws, Cambridge University Press, Cambridge, 2001.

Cilji in kompetence:	**Objectives and competences:**
Študenti poglobijo znanje s področja modeliranja v fiziki mehkih sistemov in povezavo z drugimi področji v fiziki.	Students acquire advanced knowledge on modeling in physics of soft systems and universalities.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje ključnih procesov v naravi, ki so povezani z zlomom simetrije. 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 processes in nature based on symmetry breaking. Transferable/Key Skills and other attributes: Solving of problems with mathematical tools, numerical methods, universalities in physics and gained global approach on solving problems.

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	**66.6%**	Two seminars
Ustni izpit	**33.3%**	Oral exam

Reference nosilca / Lecturer's references:

1) RANJKESH SIAHKAL, Amid, AMBROŽIČ, Milan, KRALJ, Samo, SLUCKIN, T. J. Computational studies of history dependence in nematic liquid crystals in random environments. *Physical review. E, Statistical, nonlinear, and soft matter physics*, ISSN 1539-3755, 2014, vol. 89, iss. 2, str. 022504-1-022504-14, doi: 10.1103/PhysRevE.89.022504. [COBISS.SI-ID 20347912]
2) V. Popa-Nita, S. Kralj, Random anisotropy nematic model: nematic--non-nematic mixture, Phys. Rev. E 73, 041705 (2006).
3) S. Kralj, R. Rosso, E.G. Virga, Finite-size effects on order reconstruction around nematic defects, Phys. Rev. E 81, 021702 (2010).
4) S. Kralj, R. Rosso, E.G. Virga, Curvature control of valence on nematic shells. Soft matter 7, 670 (2011).
5) 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).