

DOCTORAL STUDIES COURSE UNIT DESCRIPTION

Name of subject	Scientific Field	Faculty	Center/Institute/ Department
Phase Transitions in Solid State (8 ECTS credits)	Physics N 002	Faculty of Physics	Institute of applied electrodynamics and telecommunications
Student's workload	Hours	Student's workload	Hours
Lectures		Consultations	30
Individual study	170	Seminars	

Course annotation

Classification of solid state and phase transitions. Symmetry of crystals, symmetry elements, point and space groups. Classification of the crystals. Polar and non polar crystals. Liquids. Gases. Amorphous materials. Ferromagnetic, Antiferromagnetic. Solutions and alloys. Metals. Dielectric. Semiconductors. Superconductors. Superfluidity. Polymorphism and polytypical materials. Solid electrolytes. Ferroelectrics. Liquid crystals. Thermodynamic theory of phase transitions. Ferroelectric, ferroelastic. Superionic, metal – dielectric, ferromagnetic phase transitions. Critical phase transition. Incommensurate phases 1st and 2nd order. Dynamical properties of order – disorder phase transition. Displacive type phase transition dynamical properties. Relaxational and resonance phenomena in ferroelectrics, superionics, ferromagnetics, superconductors. Microscopic theories of phase transitions. Ferroelectric phase transitions. Superionic phase transitions. Phase transitions to superconducting state. Spectroscopy of the phase transitions. Impedance, microwave, optical, ultrasound, nuclear magnetic resonance, electron paramagnetic resonance, Mössbauer spectroscopies.

List of literature

1. J. Grigas. Segnetoelektriniai reiškiniai ir faziniai virsmai. Vilnius, VU, 1987, p.157.
2. J. Grigas. Microwave of ferroelectrics and related materials. N.Y. Gordon and Breach Publ. Inc., 1996, p.336.
3. J.G. Bednarz, K.A. Muller. Earlier and Recent Aspects of Superconductivity. Springer-Verlag Berlin Heidelberg, New York, London, Tokyo, Hong Kong. 1989, p.244.
- A. Orliukas Kietojo kūno jonika (1, 2 dalys), Vilnius, VU, 1996, p. 90, p.58.
4. Ferroelectric random access memories : fundamentals and applications / Hiroshi Ishiwara, Masanori Okuyama, Yoshihiro Arimoto, 2004, UDK 537.226.4
5. B. A. Strukov, A. P. Levaniuk Fizičeskije osnovy segnetoelektričeskich javlenij v kristaloch. M., Nauka, 1983, p.239.
6. R. Blinc, V. Žekš. Segnetoelektriki I antisegetoelektriki. M., Mir, 1975, p. 395.
7. Structural phase transitions. V. I and II. Ed. K.A. Muller and H. Thomas. Springer-Verlag 1981, p.380.
8. Lines, M.E.; Glass, A.M. Principles and applications of ferroelectrics and related materials / by M.E. Lines and A.M. Glass Oxford : Clarendon Press, 2004. xiii, 680 p. :

Consulting teachers	Scientific degree	Pedagogical name	Main scientific works published in a scientific field in last 5 year period
Robertas Grigalaitis	Dr.	Prof.	1. Dipolar glass state in BaCe _{0.3} Ti _{0.7} O ₃ perovskite solid solutions. By: Svirskas, Sarunas; Adamchuk, Dmitry; Grigalaitis, Robertas; et al. JOURNAL OF ALLOYS AND COMPOUNDS Volume: 854

			<p>Article Number: 155755 Published: FEB 15 2021.</p> <p>2. Suppression of phase transitions and glass phase signatures in mixed cation halide perovskites. By: Simenas, Mantas; Balciunas, Sergejus; Wilson, Jacob N.; et al. NATURE COMMUNICATIONS Volume: 11 Issue: 1 Article Number: 5103 Published: OCT 9 2020</p> <p>3. Phase Transitions in the Metastable Perovskite Multiferroics BiCrO₃ and BiCr_{0.9}Sc_{0.1}O₃: A Comparative Study. By: Cardoso, Joao Pedro; Delmonte, Davide; Gilioli, Edmondo; et al. INORGANIC CHEMISTRY Volume: 59 Issue: 13 Pages: 8727-8735 Published: JUL 6 2020</p> <p>4. Dielectric Spectroscopy of Water Dynamics in Functionalized UiO-66 Metal-Organic Frameworks. By: Balciunas, Sergejus; Pavlovaite, Diana; Kinka, Martynas; et al. MOLECULES Volume: 25 Issue: 8 Article Number: 1962 Published: APR 2 2020</p> <p>5. Broad-band measurements of dielectric permittivity in coaxial line using partially filled circular waveguide. By: Svirskas, Sarunas; Jablonskas, Dziugas; Rudys, Saulius; et al. REVIEW OF SCIENTIFIC INSTRUMENTS Volume: 91 Issue: 3 Article Number: 035106 Published: MAR 1 2020.</p>
<p>Certified during Doctoral Committee session 02/02/2022, protocol No. (7.17 E) 15600-KT-32</p>			<p>Committee Chairman prof. S. Juršėnas</p>