1. Annotation

Course Description

Principle notions and phenomena being specific for partially ordered media and amorphous state are considered. Examples and illustrations are provided for liquid crystals, plastic crystals (rotary crystals), nanocrystals, and partially ordered polymer structures. Phase transitions in these systems are accented, as well as the role of defects and dislocations. Optical properties of partially disordered systems are addressed. The systems consisting of nm- and sub-mkm-size particles are also discussed.

Course Prerequisites

Knowledge of thermodynamics and optics in frames of a standard course of general physics.

2. Structure and Content

Course Academic Level

Master-level course suitable for PhD students

Number of ECTS credits

3
<table>
<thead>
<tr>
<th>Topic</th>
<th>Summary of Topic</th>
<th>Lectures (# of hours)</th>
<th>Seminars (# of hours)</th>
<th>Labs (# of hours)</th>
</tr>
</thead>
</table>
| Disordered and partially disordered systems.| 1. Types of condensed media. Notion of partially ordered media. Types of partially ordered media, amorphous state, liquid crystals, plastic crystals (rotary crystals), nanocrystals, partially ordered polymer structures.  
3. Order parameter, methods of measurement of the degree of orientational and translational ordering.                                                                                                                                                                                                                                                                                                                                                   | 6                     | 2                      |                  |
| Optical properties.                         | 1. Optical properties of condensed ordered and partially ordered media. Relation of optical properties of a medium with its symmetry.  
2. Chirality. Chiral structures. Structures formed as a result of competing interactions, frustration.  
2. Dislocations in partially ordered media. TGB phases. Structures with bond orientational order. Kosterlitz-Thouless transition, dislocation melting.                                                                                                                                                                                                                                                                         | 4                     | 2                      |                  |

3. Assignments
### Assignment Summary

<table>
<thead>
<tr>
<th>Assignment Type</th>
<th>Assignment Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>For each of five topics (see in the Content above), 3 problems will be proposed.</td>
</tr>
</tbody>
</table>

### 4. Grading

<table>
<thead>
<tr>
<th>Type of Assessment</th>
<th>Graded</th>
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</table>

#### Grade Structure

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Activity weight, %</th>
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<tbody>
<tr>
<td>Attendance</td>
<td>10</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>50</td>
</tr>
<tr>
<td>Final Exam</td>
<td>40</td>
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#### Grading Scale

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<tr>
<th>Grade</th>
<th>Percentage</th>
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<tr>
<td>A</td>
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<tr>
<td>B</td>
<td>65</td>
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<tr>
<td>C</td>
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<tr>
<td>D</td>
<td>45</td>
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<tr>
<td>E</td>
<td>35</td>
</tr>
<tr>
<td>F</td>
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</table>

### 5. Basic Information

**Course Term (in context of Academic Year)**

Term 2

**Course Delivery Frequency**

Every year

### 6. Textbooks and Internet Resources

#### Required Textbooks

<table>
<thead>
<tr>
<th>ISBN-13 (or ISBN-10)</th>
<th>Book Title</th>
<th>Author(s)</th>
<th>Publisher</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>9789048188291</td>
<td>Structure and Properties of Liquid Crystals</td>
<td>L.M. Blinov</td>
<td>Springer</td>
<td>2011</td>
</tr>
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</table>

#### Recommended Textbooks

<table>
<thead>
<tr>
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<th>Year</th>
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### 7. Facilities

**Software**

Matlab

### 8. Learning Outcomes
Knowledge

Knowledge of the specific features of the most typical various partly disordered and amorphous systems.

Skill

Ability to analize the experimental data for partly disordered and amorphous systems.

Experience

Experience of reading and analysis of scientific literature related to structural and optical properties of partly disordered systems.

Do you want to specify outcomes in another framework?

Knowledge-Skill-Experience is good enough

9. Assessment Criteria

Select Assignment 1 Type

Homework

Input Example(s) of Assignment 1 (preferable)

Consider the X-ray data for certain liquid crystal proposed by Instructor. Determine the type of lattice and the closest distances for this crystal. Estimate the degree of the orientational ordering.

Assessment Criteria for Assignment 1

Qualitatively correct assignment of the lattice type. Quantitatively correct final values.

Select Assignment 2 Type

Homework

Input Example(s) of Assignment 2 (preferable)

Consider phase diagram of the system proposed by Instructor. Propose the experimental procedure to fabricate liquid crystal in this system.

Assessment Criteria for Assignment 2

Qualitatively correct description of the procedure, reasonable choice of cited literature.

Select Assignment 3 Type

Homework

Input Example(s) of Assignment 3 (preferable)

Consider experimental optical spectrum for photonic crystal proposed by Instructor. Estimate the degree of crystal ordering. Comment on possible applications of this photonic crystal.

Assessment Criteria for Assignment 3

Correct estimates, reasonable choice of cited literature.

10. Additional Notes

Free Style Comments (if any)
