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561525-EPP-1-2015-1-LV-EPPKA2-CBHE-JP



BSU



Co-funded by the
Erasmus+ Programme
of the European Union

Improvement of master-level education in the field of physical sciences in Belarusian universities

WP2 Development and modernizing of curricula
Belarusian State University



Goal of presentation:

- **Remembering of the WP2 tasks**
- **Current status of WP2** (e-Books, curricula, study programs, etc.)
- **Current status of tender procedure (WP6)**
- **Next steps**



Remembering of the WP2 tasks

- *Preparation e-Books "FNM" and "Photonics"* (current status);
- *Development, modernizing and accreditation of new muster-level curricula* in BSU (current status);
- *Internal validation of study programs* in BSU (current status);
- *Didactic materials preparation* in BSU (current status);



Remembering of the WP2 tasks

- ***Preparation e-Books "FNM" and "Photonics"*** (current status);



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Progress of e-Book “Functional nanomaterials”

Version: 26.06.2017

The course leader: Alexander FEDOTOV - BSU

Chapters/Papers	University	Contributors	Current state
Executive summary	BSU	A. Fedotov, V. Odzhaev	Eng-In progress
Introduction	BSU	A. Fedotov, V. Odzhaev	Eng-In progress
Chapter 1: Concepts of Low-Dimensional Effects	BSU	A. Fedotov	Eng-In progress
Chapter 2: Introduction to Physics of Surface/Interface	BSU	A. Fedotov	<u>Abstract-rus, Abstract-eng,</u> <u>Introduction to Physics and</u> <u>Chemistry of Surface –rus-</u> <u>01.10.2016</u> Eng-In progress
Chapter 3: Thermal Properties of Nanomaterials	BSU	M. Tivanov	<u>Abstract of Chapter 3 RUS</u> Eng-In progress
Chapter 4: Chemistry of Nanomaterials	BSU	A. Mazanik	Rus?? Eng??



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Chapters/Papers	University	Contributors	Current state
Chapter 5: Physics of Carbon Low-dimensional Systems and Device Structures	BSU	N. Poklonski	Abstract-rus, Abstract-eng Rus-In progress Chapter 5-eng-23.10.2016
Chapter 6: Arrays of carbon nanostructures: fabrication, properties and applications	BSU	V. Ksenevich	Abstract-rus, Abstract-eng Chapter 6-rus_23-01-2017 Eng-In progress
Chapter 7: Conductive Polymers	BSU	V. Odzhaev (V.Odjaev)	Abstract-rus, Abstract-eng Chapter 8-rus_27-02-2017 Eng-In progress
Chapter 8: Electrically conductive nano-composites	BSU	N. Gorbachuk, A. Fedotov	Abstract-rus, Abstract-eng Chapter 8-rus_27-02-2017 Eng-In progress
Chapter 9: Magnetotransport and Magnetism in Nanocomposite and Multilayered Materials	BSU	J. Fedotova, J. Kasiuk A. Fedotov	Abstract-rus, Abstract-eng Eng-In progress



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Chapters/Papers	University	Contributors	Current state
Chapter 10: Nanoscale Materials and Structures for Spintronics	BSU	M. Lukashevich	Abstract-rus, Abstract-eng Chapter 10-rus-23.10.2016 Eng-In progress
Chapter 11: Nanomaterials for Power Engineering	BSU	A. Mazanik	Abstract-rus, Abstract-eng Rus-In progress Eng-In progress
Chapter 12: Fluorescent quantum dots for bioimaging	GrSU	N. Strekal	Abstract-rus, Abstract-eng Chapter 12-rus-21.06.2017 Chapter 12-eng-22.01.2017
Chapter 13: Plasmonic nanomaterials for photonics, biochemistry and quantum technology	GrSU	N. Strekal	Abstract-rus, Abstract-eng Chapter 13-rus-21.06.2017 Chapter 13-eng-22.01.2017



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Chapters/Papers	University	Contributors	Current state
Chapter 14: Nanofibers: synthesis, properties and applications	BSTU	N.R. Prokopchuk, Zh.S. Shashok	Abstract-rus, Abstract-eng Chapter 14-rus-23.10.2016 Chapter 14-eng-23.10.2016
Chapter 15: Elastomeric compositions with carbon nanomaterials	BSTU	K.V. Vishnevskii, Zh.S. Shashok	Abstract-rus, Abstract-eng Chapter 15-rus-23.10.2016 Chapter 15-eng-23.10.2016
Chapter 16: Paints and coatings, modified carbon nanomaterials	BSTU	N.R. Prokopchuk, A.L. Shutova	Abstract-rus, Abstract-eng Chapter 16-rus-23.10.2016 Chapter 16-eng-23.10.2016
Chapter 17: Plasma-chemical synthesis of nanocomposite polymer coatings	GSU	A.V. Rogachev, A.A. Rogachev, M. Yarmolenko	Abstract-rus, Abstract-eng Chapter 17-rus-21.06.2017 Chapter 17-eng-23.10.2016



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Chapters/Papers	University	Contributors	Current state
Chapter 18: Carbon coatings doped with metals	GSU	A.V. Rogachev, D.Pilipcov, N. Fedosenko	Abstract-rus, Abstract-eng Chapter 18-rus-23.10.2016 Chapter 18-eng-21.06.2017
Chapter 19: Sol-gel synthesis of functional materials	GSU	D. Kovalenko V. Gaishun A. Semchenko	Abstract-rus, Abstract-eng Chapter 19-rus-23.10.2016 Chapter 19-rus-21.06.2017
Chapter 20: Micro- and nanosensors	KU Leuven	Joan Peuteman	Chapter 20-eng-23.10.2016 Rus?? 2 papers
References			



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Progress of e-Book “Photonics”

Version: 21.06.2017

The course leader: Alexey TOLSTIK - BSU

Chapters/Papers	University	Contributors	Current state
Executive summary	BSU	A.Tolstik	Eng-In progress
Introduction	BSU	A.Tolstik	Eng-In progress
Chapter 1: Laser physics	BSU	A.Tolstik	Abstract-eng <u>Photonics Chapter 1.0. Laser physics. Rus</u> <u>Photonics Chapter 1.0. Laser physics. Eng</u>



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The course leader: Alexey TOLSTIK - BSU

Chapters/Papers	University	Contributors	Current state
Chapter 2: Nonlinear optics	BSU	A.Tolstik	In progress
2.1.			Eng-In progress
2.2.			Eng-In progress
2.3. Second harmonic generation. Phase-matching conditions			Photonics Chapter 2.3. Second harmonic generation. Phase-matching conditions. Rus Eng-In progress
2.4.			Eng-In progress
2.5. Stimulated Raman scattering. Stimulated Brillouin scattering.			<u>Chapter 2.5. rus</u> Eng-In progress



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Chapters/Papers	University	Contributors	Current state
Chapter 3: Coherent Optics and Holography	BSU	A. Melnikova	Abstract-eng Photonics Chapter 3.0. Rus Eng-In progress
3.0. Coherent optics and Holography	BSU	A. Melnikova	<u>Chapter 2.5. Stimulated Raman scattering. Stimulated Brillouin scattering. rus</u> Eng-In progress
3.1. Spatial and temporal coherence.	BSU	A. Melnikova	Photonics Chapter 3.1. Rus Eng-In progress
3.2-3.6	BSU	A. Melnikova	Eng-In progress
3.7. Holographic interferometry.	GrSU	A. Ljalikov	Rus?? Photonics Chapter 3.7. Holographic interferometry. eng



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Chapters/Papers	University	Contributors	Current state
Chapter 4: Optoelectronics			Eng-In progress
4.1. Physics of Condensed Matter	BSU	A. Fedotov	Photonics Chapter 4.1. Solid state physics. rus Photonics Chapter 4.1. Solid state physics. eng
4.2. Semiconductor optical detectors	KU Loven	J. Peuteman	Photonics Chapter 4.2. Semiconductor optical detectors. Eng Rus??
4.3. Solar cells	BSU	M. Tivanov	<u>Photonics Chapter 4.3 Solar cells. rus</u> Eng-In progress
4.4. Applications of photovoltaic systems	KU Loven	J. Peuteman	Photonics Chapter 4.4. Applications of photovoltaic systems. Eng Rus??



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Chapters/Papers	University	Contributors	Current state
Chapter 5: Optical waveguides	BSU	D. Gorbach	<u>Photonics Chapter 5 Abs</u> Eng-In progress
5.1. Optical waveguides	BSU	D. Gorbach	Photonics Chapter 5.1. Rus Eng-In progress
5.2. Waveguide modes	BSU	D. Gorbach	Photonics Chapter 5.2. Waveguide modes. Rus Eng-In progress
5.3. Input-output system	BSU	D. Gorbach	Photonics Chapter 5.3. Rus Eng-In progress
5.4. Fibre optical transmission system	BSU	D. Gorbach	Photonics Chapter 5.4. Rus Eng-In progress
5.5. Fibre sensors	BSU	D. Gorbach	Eng-In progress



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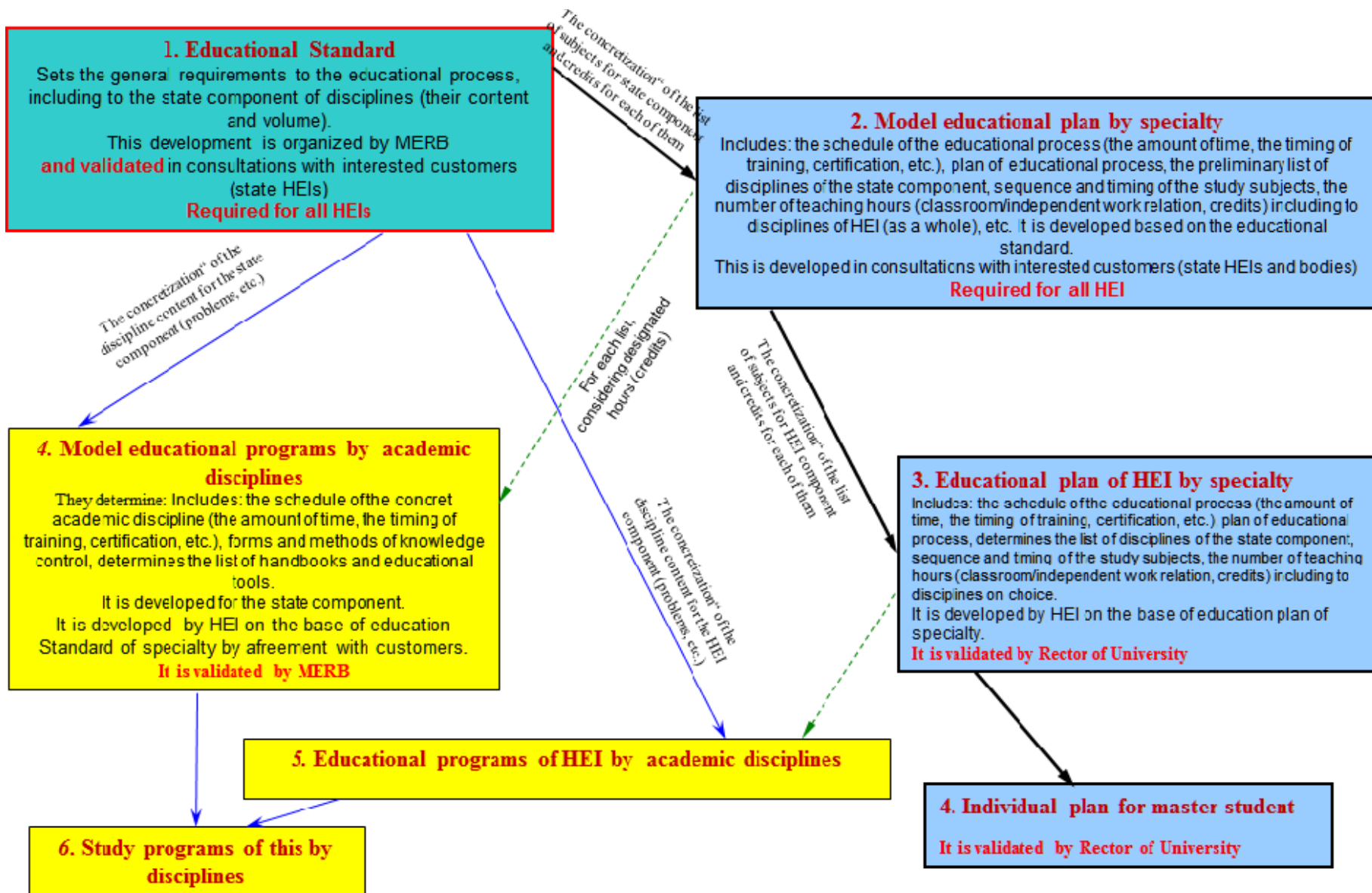
The course leader: Alexey TOLSTIK - BSU

Chapters/Papers	University	Contributors	Current state
Chapter 6: Nanophotonics	GrSU	N. Strekal	Eng-In progress
6.1. Quantum and classical confinement effect	GrSU	N. Strekal	Rus?? <u>Photonics Chapter 6.1-6.3. eng.</u>
6.2. Density of states and modified density of states in system of low dimensionality	GrSU	N. Strekal	Rus?? <u>Photonics Chapter 6.1-6.3. eng.</u>
6.3. Breaking through the diffraction limit and near-field optics	GrSU	N. Strekal	Rus?? <u>Photonics Chapter 6.1-6.3. eng.</u>
6.4. Quantum dots and basic ideas of nanophotonic devices	GrSU	N. Strekal	Eng-In progress
6.5. Molecular electronics and photonics devices	GrSU	G. Vasilyuk	Photonics Chapter 6.5. rus 3 Photonics Chapter 6.5. eng 3



The current status of curricula preparation:

- Educational Standards are approved,
- MERB finishes validation of curricula
- BSU validation of study programs of courses





Structure of curricula “Functional Nanomaterials”

List of courses for the two-year master-level education
on specialty 1-31 81 04 **FUNCTIONAL NANOMATERIALS**

State component
(about 30 %)

University component

**Elective courses/
Courses on choice**



Structure of curricula “Functional nanomaterials”

State component

№	The titles of activity of the undergraduate, cycles of disciplines, disciplines	Scope of work (hours)			Credits
		Total hours	Of them		
			Auditory lessons	Independent work	
1	Special training disciplines	2866	1080	1786	60
1.1	State component	840	316	524	16
1.1.1	Philosophy of physics and the technosphere	42	20	22	1
1.1.2	Physics of condensed matter	130	46	84	2
1.1.3	Physics of wave processes	150	40	110	3
1.1.4	Electronic properties of materials	154	54	100	3
1.1.5	Physics of low-dimension systems	122	40	82	2
1.1.6	Pedagogy and psychology of the higher school	84	56	28	2
1.1.7	Nanostructured materials and methods of their study и методы их исследования	158	60	98	3
1.2	University component	2026	764	1262	44



Structure of curricula “Functional nanomaterials”

University and Elective Component

No	Course name	Level	Preliminary number of students	Type of delivery (Lecture, lab, pract)	Semester
1.	Nanostructured materials and methods of their study	Master	10	Lecture	1
2	Synthesis of nanomaterials	Master	10	Lecture	1
3	Nanotechnology in electronics	Master	10	Lecture	1
4	Low Dimensional Systems	Master	10	Lecture	1
5	Modern concepts of the structure of matter	Master	10	Lecture	1
6	Condensed Matter Physics	Master	10	Lecture, lab	1
7	Polymer physics	Master	10	Lecture	2
8	Physics and chemistry of surface	Master	10	Lecture	2
9	Low dimensional systems (Special chapters)	Master	10	Lecture	3
10	Optics of nanostructures	Master	10	Lecture, lab	3
11	Theory of transfer	Master	10	Lecture, lab	3



Structure of curricula “Photonics”

List of courses for the two-year master-level education
on specialty 1-31 81 02 **PHOTONICS**

State component

University component

**Elective courses/
Courses on choice**



Structure of curricula “Photonics”

State component

№	The titles of activity of the undergraduate, cycles of disciplines, disciplines	Scope of work (hours)			Credits
		Total hours	Of them		
			Auditory lessons	Independent work	
1	Special training disciplines	2362	1080	1282	60
1.1	State component	660	316	344	16
1.1.1	Philosophy of physics and the technosphere	42	20	22	1
1.1.2	Physics of condensed matter	94	46	48	2
1.1.3	Physics of wave processes	114	40	74	3
1.1.4	Molecular spectroscopy and luminescence	118	54	64	3
1.1.5	Laser systems	86	40	46	2
1.1.6	Pedagogy and psychology of the higher school	84	56	28	2
1.1.7	Nanophotonics	122	60	62	3
1.2	University component	1702	764	938	44



Structure of curricula “Photonics” University and Elective Component

No	Course name	Level	Preliminary number of students	Type of delivery (lecture, lab, pract)	Semester
1.	Nanostructured materials and methods of their study	Master	10	Lecture	1
2	Synthesis of nanomaterials	Master	10	Lecture	1
3	Nanotechnology in electronics	Master	10	Lecture	1
4	Low Dimensional Systems	Master	10	Lecture	1
5	Modern concepts of the structure of matter	Master	10	Lecture	1
6	Condensed Matter Physics	Master	10	Lecture, lab	1
7	Polymer physics	Master	10	Lecture	2
8	Physics and chemistry of surface	Master	10	Lecture	2
9	Low dimensional systems (Special chapters)	Master	10	Lecture	3
10	Optics of nanostructures	Master	10	Lecture, lab	3
11	Theory of transfer	Master	10	Lecture, lab	3



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Next steps to September 1st, 2017

- 1. Completion of study programs by disciplines**
- 2. Completion of lecture synopsis and presentations**



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Problems

- 1. Participation of MERB and RANI in the project**
- 2. Reviewing of curricula and study programs by Associated Partners**



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Thank you for attention
Questions?

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Improvement of master-level education in the field of physical sciences in Belarusian universities

WP6: Management

Belarusian State University



6.6 Purchasing of equipment, hardware, software for physical and virtual labs:

6.6.1 Technical specifications development

6.6.2 Launch of procurement procedure

6.6.3 Evaluation of the equipment offers, contracts and supply (Belarusian universities)



6.6 Purchasing of equipment, hardware, software for physical and virtual labs

Equipment	Approved by the Ministry of Economy	Technical specifications are prepared	List of Companies to be invited to tender is prepared
Scanning probe microscope	Yes	Yes (2 variants)	Yes (6 Companies)
Hardware-software complex for distance education	Yes	Yes	Yes (3 Companies)
Argon laser with optical elements	Yes	Yes	Yes (3 Companies)
Helium-neon laser	Yes	Yes	Yes (3 Companies)
Digital camera	Yes	Yes	Yes (3 Companies)



6.6 Purchasing of equipment, hardware, software for physical and virtual labs

Action	Tender procedure			Contractual deadline			
	Start of tender procedure		Contracts signing, receipt of a tranche (50%) for equipment from Riga				Receiving of equipment, payment of the remaining amount from the BSU funds
Month	June		July	August	September	October	November



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