

# SUMMIT

**Third Annual Conference, April 2026**

Sofia University St. Kliment Ohridski

Sofia, Bulgaria



SOFIA UNIVERSITY  
MARKING MOMENTUM  
FOR INNOVATION AND  
TECHNOLOGICAL TRANSFER



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National Recovery and Resilience Plan



OF THE REPUBLIC OF BULGARIA

# PROGRAM

21.04.2026  
22.04.2026



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## 21 april 2026, program summary

Aula, Rectorat, Tsar Osvoboditel Blvd 15		
9:00-10:00	Registration and complimentary coffee	
10:00-11:30	<b>Opening ceremony</b>	
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11:30-12:30	Poster session	p. 9
12:00-14:00 Lunch break, "Alma Mater" restaurant		
16:00-16:30 Coffee break		

Central lobby, Rectorat, Tsar Osvoboditel Blvd 15		
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## 21 april 2026, program summary

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	<b>3.1.11 Algology (Algal Collections),</b> Assoc. Prof. Blagoy Uzunov, PhD	p. 11
	<b>3.2.4 Microbiological risks in the environment,</b> Sergei Ivanov, PhD	p. 12
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14:00-18:00	<b>3.1.1 Mathematical physics and Astrophysics,</b> Prof., DSc Stoytcho Yazadjiev	p. 14
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14:00-18:00	<b>3.1.16 ICT Applications for History And Language,</b> Prof. DSc Anna-Maria Totomanova/ Assoc. Prof. Dr. Maria Baramova	p. 15
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9:00-13:00	<b>3.1.14 Nuclear</b> , Assoc. Prof. PhD, Krasimir Mitev	p. 27
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## 22 april 2026, program summary



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### Conference Hall, Rectorat, Tsar Osvoboditel Blvd 15

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### Auditorium 23, Rectorat, Tsar Osvoboditel Blvd 15

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### Auditorium 45, Rectorat, Tsar Osvoboditel Blvd 15

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14:00-18:00	<b>3.1.13 Climate, Weather and Natural Risks (CW&amp;NR)</b> , Assoc. Prof. Dr. Guergana Guerova	p. 36

### Auditorium 63, Rectorat, Tsar Osvoboditel Blvd 15

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# PROGRAM 21 April



**Aula, Rectorat, Tsar Osvoboditel Blvd 15**

<b>Aula, Rectorat, Tsar Osvoboditel Blvd 15</b>	
9:00-10:00	Registration and complimentary coffee
10:00-11:30	<p><b>Opening ceremony</b></p> <p>Address to the Conference from Official Guests</p>
	<p><b>SUMMIT: THIRD YEAR OVERVIEW</b></p> <p><b>prof. Vasil Marinov</b>, Coordinator research groups - SUMMIT</p>

**Poster session for the 3.4 Groups**

<b>Poster session for the 3.4 Groups</b>	
All day	Central lobby, Rectorat, Tsar Osvoboditel Blvd 15

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<b>Lunch break</b>	
<b>21 April</b> 12:00-14:00	“Alma Mater” restaurant

<b>Coffee break</b>	
<b>21 April</b> 16:00-16:30	<b>Central lobby</b> – for the groups in the Aula, Hall 1, Hall 2 and the Egg. <b>South Wing lobby</b> – or the groups in Auditoriums 23, 45 <b>In front of the Conference Hall</b> – for the group inside

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### 3.1.8 Plant parasites, Assoc. Prof. Dr Lyuben Zagorchev, lead researcher

14:00-18:00 - **Aula, Rectorat**

16:00-16:30 Coffee break

Lyuben Zagorchev

**Biology of parasitic plants -  
major achievements and future  
perspectives**

Martin Savov

**Ion fluxes under abiotic stress -  
how are *Cuscuta* spp. different  
from non-parasitic relatives**

Stefan Savov

**The endophytic microbiome of  
*Cuscuta* spp. - dependence on the  
host species and involvement in  
gall formation**

### 3.1.8 Plant parasites, Assoc. Prof. Dr Lyuben Zagorchev, lead researcher

During the period 2023–2026, the research group “Plant Parasites” at Sofia University conducted extensive studies on some of the most fascinating yet problematic plants – parasitic species from the genus *Cuscuta* (dodders). These plants are unable to sustain themselves independently and instead attach to host plants, extracting water and nutrients, which makes them a serious threat to agriculture.

The main objective of the research was to understand how these parasites spread, how they interact with their hosts, and what biologically active compounds they contain. The results are important both for developing resistant crops and for potential applications in medicine.

Within the project, more than 130 samples of different *Cuscuta* species were collected across Bulgaria, and a predictive model for their future distribution was developed. The genetic diversity of these plants was characterized, and a unique seed collection for scientific research was established.

A major contribution of the project is the elucidation of the mechanisms by which parasitic plants infect their hosts. Key enzymes and proteins involved in this process were identified, as well as factors that enhance host resistance, particularly in crops such as tomato. This opens new possibilities for developing strategies to protect agricultural plants.

The research also demonstrated that *Cuscuta* can transfer microorganisms between plants, including potential pathogens, making it an important factor in disease spread. In addition, it was shown that the parasite responds differently to environmental stress, relying heavily on its host for survival.

Another important aspect of the project was the analysis of biologically active compounds in these plants. The results showed that *Cuscuta* species contain flavonoids and other specialized metabolites with strong antioxidant and antiviral activity, including effects against human viruses. This highlights their potential as a source of novel natural therapeutics.

The project also significantly contributed to capacity building by involving young researchers, supporting doctoral and student theses, and establishing international collaborations with universities in Europe, Australia, and Asia. Modern equipment was acquired, enabling advanced molecular and biochemical analyses.

In conclusion, the project results not only expand scientific knowledge on parasitic plants but also have direct applications in agriculture and medicine. The established research infrastructure and international partnerships ensure sustainable development of this research field in the future.



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### 3.1.11 Algology (Algal Collections), Assoc. Prof. Blagoy Uzunov, PhD, lead researcher

14:00-18:00 - **Aula, Rectorat**

16:00-16:30 Coffee break

Blagoy Uzunov

#### **Final Overview**

Kristian Ivanov, Maya Stoyneva-Gärtner &

Blagoy Uzunov

#### **Selected ACUS strains: taxonomy, analysis and classification**

Velichka Marinova, Maya Stoyneva-Gärtner &

Blagoy Uzunov

#### **Bioreceptive concrete: towards sustainable and living urban surfaces**

### 3.1.11 Algology (Algal Collections), Assoc. Prof. Blagoy Uzunov, PhD, lead researcher

The Living Algal Collection of Sofia University (ACUS) is a key resource, providing strains with high biotechnological potential for both basic and applied research. It houses unique algal strains isolated from various habitats in Bulgaria, serving as a biodiversity repository of significance for future generations.

Within the SUMMIT project, the laboratory in the Faculty of Biology, which houses ACUS, was renovated, and the collection's equipment was renewed and modernised with three growth chambers for culturing microalgae under controlled conditions and a horizontal tubular photobioreactor.

A microscopy room was created, equipped with new research technology, including an inverted Nikon Eclipse Ti2-U microscope with camera and a TrakJectorTM micromanipulator, as well as a Nikon SMZ18 stereomicroscope with camera, which are used for single-cell isolation, routine monitoring, and photo-documentation of cultivated strains.

During the project, two established foreign scientists were engaged as pro bono consultants. To ensure continuity of expertise, two PhD candidates were recruited to the team and successfully trained in the specific work of the Collection, including isolation, adaptation, maintenance, and long-term cultivation of living algal strains from diverse taxonomic and ecological groups. As a result, the two young researchers deposited over 100 new strains with promising properties for industrial application. Subsequently, a third

PhD candidate joined the team, researching the application of algae for colonising innovative eco-plasters aimed at improving air quality and microclimate in urban environments. For activities on wastewater treatment using algal strains from ACUS, an external expert from the University of Architecture, Civil Engineering and Geodesy was also engaged. In addition, the collection's resources were used in the specialisation of a visiting foreign researcher who, after the specialisation, was habilitated as an Associate Professor, and in the development of diploma theses by foreign students.

To disseminate project results, the scientific team participated in eight international conferences (presenting 17 talks), international programmes, and COST actions. An international agreement and memorandum with other universities were initiated. Project funding supported the preparation of 13 scientific publications in peer-reviewed journals. The scientific team also secured external funding and industrial support through contracts with Bulgarian companies for phytoplankton monitoring and the development of early-warning systems for cyanotoxins. Nationally, the team also took part in European Researchers' Night, the "Science and Technology" programme on Bulgarian National Radio, a podcast organised by Sofiyska Voda AD, and a meeting of the EU Mission for the Restoration of Oceans, Seas and Inland Waters to the European Commission.



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### 3.2.4 Microbiological risks in the environment,

**Sergei Ivanov, PhD, lead researcher**

14:00-18:00 - **Aula, Rectorat**

16:00-16:30 Coffee break

Sergei Ivanov

**The new laboratory created under the SUMMIT project - modern technologies and approaches for the study and prevention of infectious diseases**

Anton Hinkov

**Recovery of human viral pathogens from wastewater samples in cell culture model**

Yoana Kizheva

**Antibacterial efficacy of Bulgarian Bacteriophages Against Multidrug-Resistant Bacteria.**

Zoltan Urshev

**Wastewater metagenomic data bioinformatic processing.**

David Binev

**Trends in the levels of human pathogenic viruses in the wastewaters of major Bulgarian cities**

### 3.2.4 Microbiological risks in the environment,

**Sergei Ivanov, PhD**, lead researcher

The project equipped a new laboratory at the Faculty of Biology of Sofia University, possessing apparatuses for molecular diagnostics and pathogen manipulation at BSL 2+ level. The laboratory developed methods unique to Bulgaria:

- Isolation of pathogenic viruses from the environment – waste, drinking, sea water, soil and food.
- Identification and whole-genome sequencing of viruses and bacteria from the environment.
- Next-generation metagenomic sequencing (NGS) of DNA/RNA for identification and characterization of microbial populations and pathogens from the environment.
- Bioinformatics, application of new software and algorithms for processing large volumes of sequencing data.

The main objective of the project was to monitor the wastewater of large cities to track the epidemiological situation. This new field of science is called wastewater-based epidemiology. Secondary tasks related to public health were additionally included. The more significant results of the project are:

- The main wastewater sampling program included the cities of Sofia, Plovdiv, Varna and Burgas. Over 180 visits to the wastewater treatment plants were carried out over 2 years, practically every week. Sample processing and pathogen identification was reduced to 3 days. The results show the current epidemiological situation for nearly 40% of the population of Bulgaria on a weekly basis. In case of deviations from the usual, for example, a strong increase in the levels of a certain virus, a warning was issued, publicly available on the specialized website <https://clinica.bg>.
- The processed wastewater samples are stored in liquid nitrogen in the laboratory. They are the history of infectious diseases in the respective cities for the last 2 years, which is a priceless collection.
- By inoculating wastewater samples on cell cultures,

viruses from the human pathogenic genera Adenovirus and Enterovirus were cultivated and characterized for the first time in Bulgaria. The genome of 8 new viruses was sequenced and the information was deposited in the international genome bank.

- Twelve new bacteriophages (viruses that attack bacteria) were isolated from wastewater. These specific viruses are a gift from nature because they destroy bacteria pathogenic to humans that are otherwise resistant to antibiotics. Two of these new bacteriophages were fully sequenced and characterized. This activity marks the beginning of a unique new collection of beneficial viruses, an alternative to antibiotics, capable of supplementing the control of infections resistant to modern medicine.
- In cooperation with the non-governmental organization “Active Consumers”, bathing water was examined on a number of beaches along the southern Black Sea coast. Significant deviations from hygiene standards during the tourist season were found. Over 20 pathogenic bacteria originating from fecal waters have been identified in seawater.
- The safety of hot drinking water in cities with a public heating network, Sofia, Plovdiv and Pleven, was studied. It was found that the temperature of hot drinking water heated in building installations is usually lower than the recommended 55 degrees. The consequence is an increase in the amount of bacteria up to 70 times, compared to the baseline cold water flowing from the neighboring tap. Metagenomic analysis, for the first time in the world in such an experiment, shows a radical change in the microbiome of heated water. An increase in the levels of a number of pathogenic bacteria, for example Legionella pneumophila, was found. The conclusion is that drinking water heated in the public network may pose a risk to the health of consumers, which requires urgent legislative decisions, as well as monitoring and correction programs.



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### 3.1.15 European Values and Social Challenges /EuVaSC/, Prof. Maria Stoicheva, PhD, lead researcher

14:00-18:00 - **Hall 1, Rectorat**

16:00-16:30 Coffee break

Prof. Dr. Maria Stoicheva  
**Opening and overview of the group activities**

**Panel I: European Values, Intercultural Dialogue and the Role of Universities**

Chair: Assoc. Prof. Dr. Nikolina Tsvetkova

**Prof. Dr. Michael Byram**, Towards Academic Intercultural (Communicative) Competence

**Dr. Martyn Barrett**, The Relationship between Basic Human Values and EU Values

**Assoc. Prof. Nikolina Tsvetkova, Dr. Antoaneta Getova**, Promoting active citizenship with young people – lessons from an empirical study

**Prof. Dr. Irini Jacobberger**, On Promoting Multilingualism/Plurilingualism in Europe (Illustrated through the Institutional Language Policy of the European Union and the Council of Europe)

**Prof. Dr. Kai Eno Lehmann**, The challenges of academic internationalization in Brazil – A case study of the Institute of International Relations at the University of São Paulo (IRI-USP)

**Assoc. Prof. Tamilla Mammadova**, Cultural Diversity in Cross-cultural settings: Multidisciplinary perspectives

Discussion

**Panel II: Academic Freedom as a Basic Value (Interdisciplinary Perspectives)**

Chair: Prof. Dr. Maria Stoicheva

**Discussants:**

**Prof. Dr. Michael Byram**  
(EUVaSC Group, Professor Emeritus University of Durham, Guest Research Professor, Sofia University St Kliment Ohridski)

**Assoc. Prof. Dr. Nikolina Tsvetkova**  
(EUVaSC Group, Sofia University St. Kliment Ohridski)

**Acad. Ivan Ilchev**  
(Sofia University St. Kliment Ohridski)

**Prof. Dr. Quentin Michelle**  
(Liege University, Belgium)

**Chief Asst. Prof. Dr. Ana Lazarova**  
(Sofia University St. Kliment Ohridski)

**PhD Student Nikol Karlukova**  
(Sofia University St. Kliment Ohridski)

**The theme will be discussed from historical, genealogical, normative and value-based perspectives.**

Open discussion

### 3.1.15 European Values and Social Challenges /EuVaSC/, Prof. Maria Stoicheva, PhD, lead researcher

The Research Group “European Values and Social Challenges” explores how European societies respond to major challenges such as political crises, democratic change, and the role of education in a rapidly evolving world. Bringing together researchers from different fields, the group combines legal, political, and educational perspectives to better understand how values shape our societies and institutions.

The work of the group is important because it addresses real issues that affect people's daily lives—such as political instability, declining trust in institutions, and the impact of new technologies like artificial intelligence. By studying these challenges, the research helps improve public understanding, supports better policymaking, and contributes to stronger democratic and educational systems.

One major focus has been the resilience of democracy in Bulgaria during a period of repeated political crises. Despite multiple elections in a short time, the research shows that democracy has remained relatively stable. This is linked to factors such as respect for constitutional rules, peaceful civic participation, and continued public support for European values. At the same time, the research highlights risks, including increasing political polarization and the spread of populist ideas.

Another key area examines how constitutional systems respond to crises. The subgroup has successfully delivered three international conferences—with a fourth scheduled for June—and hosted lectures involving 55 researchers from 48 universities across Europe, North America, Asia, and the Near East, creating a strong global network. Their work has resulted in 49 scientific publications, including books and journal articles (with 22 more being written), and has developed new ways of understanding how law, politics, and society interact in times of uncertainty (almost 40 new theoretical concepts). These insights

are directly relevant for improving governance and safeguarding democratic principles.

The group also studies the future role of universities and education. It has explored doctoral education across countries and examined how young people engage in civic life through international surveys. The findings show how values, attitudes, and skills influence participation in society. Additional applied research has addressed teacher training and education in multicultural and multilingual environments, helping education systems respond to increasingly diverse societies. Further work explores the responsible use of artificial intelligence in education and the role of international solidarity in addressing global challenges. Overall, the subgroup has published altogether 39 papers, 7 have been accepted for publication and 9 more are being finalized. They have taken part in 38 conferences, have organised 7 events to engage stakeholders and fellow-academics and delivered 14 public lectures in Sofia and abroad.

Beyond academic research, the group actively communicates its findings through public events, media participation, podcasts, and an online discussion series. This ensures that the knowledge generated reaches not only experts but also citizens and decision-makers.

The SUMMIT project supporting research universities under the National Recovery and Resilience Plan has a major impact on the visibility of the research potential of Sofia University St. Kliment Ohridski. The three-year collaborative interdisciplinary work of the European Values and Social Challenges group, resulting in 36 papers, book chapters and edited volumes indexed in Web of Science and 71 indexed in Scopus, creates a solid basis for future research involving distinguished scholars from Europe and beyond.



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### 3.1.1 Mathematical Physics and Astrophysics

Prof., DSc Stoytcho Yazadjiev, lead researchers

14:00-18:00 - **Hall 2, Rectorat**

16:00-16:30 Coffee break

Prof. Stoytcho Yazadjiev  
**Opening and overview of the group activities**

Assoc. Prof. Kalin Staykov  
**Spontaneous scalarization of static and rotating neutron stars as a phase transition**

Prof. Radoslav Rashkov  
**On Entanglement from Different Viewpoint**

Assoc. Prof. Galin Gyluchev  
**Images of Kerr Black Holes with Synchronized Scalar Hair and Their Equatorial Polarization Properties**

Assoc. Prof. Tsvetan Vetsov  
**Geometric Approach to Optimal Control Theory**

Assoc. Prof. Petya Nedkova  
**On the possibility of observing wormholes by the Event Horizon Telescope**

Dr. Miroslav Radomirov  
**Complexity Dynamics of Charged Quantum Systems at Finite Temperature and External Magnetic Field**

Dr. Tsanimir Angelov  
**Effects of plasma and relativistic aberrations on the shadows of traversable wormholes**

Dr. Rasim Bekir  
**Signatures of the dark matter halo in the polarized emission around galactic black holes**

## 3.1.1 Mathematical Physics and Astrophysics

Prof., DSc **Stoytcho Yazadjiev**, lead researchers

### How We Explore the Dark Universe

About 95% of the Universe is composed of dark matter and dark energy—mysterious components that cannot be observed directly, yet whose influence shapes the structure of the cosmos. Understanding their nature is one of the greatest challenges in modern science.

Our research group addresses this problem by studying black holes and neutron stars—some of the most extreme objects in the Universe—and the fundamental laws governing spacetime and quantum information. By combining geometry, modern theoretical approaches, and advanced numerical simulations, we search for new signatures of physics beyond the currently established models.

Within the project, we developed new numerical codes to solve Einstein's equations. This enabled us to model, with great precision, physical processes occurring around black holes and neutron stars—environments where new and unknown physics may emerge.

Using these tools, we investigated how potential new fundamental fields could modify:

- gravitational waves—the “ripples” of spacetime detected by modern observatories;
- images of black holes obtained by global telescope networks such as the Event Horizon Telescope.

This approach allows us not only to search for new phenomena but also to place stringent constraints on theories describing the dark side of the Universe.

### Key Results

#### *New tools for exploring the Universe*

We developed original numerical methods and software for solving Einstein's equations, enabling high-precision simulations of extreme astrophysical processes.

#### *Improved understanding of gravitational waves*

We demonstrated how new fundamental fields could leave measurable “imprints” in gravitational-wave

signals—providing a pathway to discovering new physics.

#### *New predictions for black hole imaging*

We predicted how the polarization of light around black holes can reveal information about their structure and about possible new physical effects.

#### *Optimization of black hole evolution*

We showed that the growth and evaporation of black holes can be understood as optimal processes—proceeding with minimal energy dissipation.

#### *Quantum complexity and information*

We investigated how different physical factors affect the “complexity” of quantum systems, with potential implications for future quantum technologies.

#### *Stability and quantum effects*

We developed models describing how quantum corrections influence the stability and evolution of black holes.

#### *New theoretical approaches*

We made progress toward a holographic description of processes near black holes—a promising direction for unifying gravity and quantum physics.

### Why It Matters

Our work connects theory, observations, and numerical simulations into a unified framework. This allows us to test fundamental ideas about the structure of the Universe and to narrow down possible explanations for dark matter and dark energy.

Beyond fundamental science, the methods we develop have applications in areas such as high-performance computing and big data analysis. At the same time, our research on quantum information is closely linked to the development of future quantum technologies.

In the broadest sense, our goal is to decipher the language of nature—to understand how the Universe works at its deepest level. Black holes, dark matter, dark energy, and quantum information are key pieces of this cosmic puzzle.



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### 3.1.16 ICT Applications for History And Language,

Assoc. Prof. Dr. Maria Baramova / Prof. DSc Anna-Maria Totomanova, lead researchers

14:00-18:00 - **The Egg Conference Hall, Rectorat**

16:00-16:30 Coffee break

Maria Baramova, Kristiyan Simeonov  
**DigitalSEE: A Digital Infrastructure for the  
Study of Southeastern Europe (2023–2026)**

Kristiyan Simeonov, Maria Baramova  
**Digital Tools for history of South-Eastern  
Europe: demonstration**

Kristiyan Simeonov  
**Illuminating Space in Text: The Lumina  
Approach to Historical Data Mining**

Dimitar Iliev  
**Linked Open Data in the Study of the Past:  
DigitalSEE's Cross-platform Interoperability**

Discussion  
**AI and Digital Humanities Workflows:  
Method, Ethics, Reproducibility, and  
Sustainability**

Anna-Maria Totomanova  
**Electronic Research Infrastructure for  
Bulgarian Medieval Written Heritage in  
European Context**

Dimitar Iliev, Velichka Ilieva,  
Kristiyan Simeonov  
**Creating a Pilot Digital Collection of Old  
Church Slavonic Inscriptions**

Vasya Velinova  
**Updated online version of the Checklist of  
the Greek manuscript collection kept at  
the Ivan Duychev Scientific Center at Sofia  
University**

Tatyana Slavova, Maria Totomanova-Paneva  
**Digital processing of electronic dictionary  
entries. The four orations against the Arians**

**Discussion**

### 3.1.16 ICT Applications for History And Language,

**Assoc. Prof. Dr. Maria Baramova / Prof. DSc Anna-Maria Totomanova**, lead researchers

#### **I. Digital Innovations for Exploring the History of Southeastern Europe**

Over the past three years, a multidisciplinary team of historians, archaeologists, philologists, and data scientists, with Maria Baramova as the lead researcher, has developed digital methodologies and tools for the systematic study of Southeastern Europe:

DigitalSEE (Digital South-Eastern Europe) opens new horizons for researching the rich historical heritage of Southeastern Europe in the 18th and 19th centuries. As a comprehensive digital repository, it integrates visual and textual sources—from maps, lithographs, and engravings to travel accounts, diplomatic reports, manuscripts, and early printed books. Through advanced cross-referencing, the platform enables in-depth analysis of historical developments, with a particular focus on the Danube region and the Via Militaris.

At its core, DigitalSEE combines cutting-edge technologies with humanities research. Using TEI XML standards, AI-supported data processing, and intuitive web-based tools, historical sources are structured, analyzed, and visualized in new ways. Advanced search capabilities, metadata management, and interactive features provide innovative access for both researchers and students.

Another key component of the project is LUMINA, a tool for automated transcription and analysis of historical manuscripts. By integrating technologies such as Transkribus, Kraken, and natural language processing (NLP), LUMINA enables the extraction, contextualization, and exploration of complex multilingual sources.

The project also incorporates spatial and network analysis. A prototype tool based on the correspondence of the influential merchants Evlogi and Hristo Georgiev demonstrates how historical communication networks can be mapped and quantitatively analyzed. Interactive maps and visualizations reveal connections spanning the Ottoman Balkans, Central Europe, and beyond.

In addition, DigitalSEE advances digital cartography through the reconstruction and georeferencing of historical maps, including those by Felix Kanitz, enriched with thousands of geographic entities.

Complementing these efforts, LiDAR and GIS technologies have been applied to archaeological landscapes such as the Sboryanovo Archaeological reserve, enabling high-precision documentation and the discovery of previously unknown cultural heritage sites.



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OF THE REPUBLIC OF BULGARIA

21 April 2026



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OF THE REPUBLIC OF BULGARIA

27 April 2026

22

### 3.1.16 ICT Applications for History And Language, Assoc. Prof. Dr. Maria Baramova / Prof. DSc Anna-Maria Totomanova, lead researchers

#### II. Digital tools for the study of Bulgarian medieval written heritage

The Electronic Infrastructure for the Study of the Bulgarian Medieval Written Heritage (ELINZB), which is part of the National Roadmap for Research Infrastructures, is the main tool for the study of not only the Bulgarian, but also the Orthodox Slavic written heritage. It consists of two main pillars: the Histdict system and the e-Medievalia training platform. Histdict includes an Electronic Corpus with digitally collected works and translations of Old Bulgarian writers from the 9th to the 18th centuries and the associated electronic tools for text processing, digitized dictionaries and specialized software for the development of synchronous and diachronic digital dictionaries. The e-Medievalia platform supports 37 interactive courses, divided into 12 modules, covering all areas of the humanities. The courses on Old Bulgarian, History of the Bulgarian Language and Old Bulgarian Literature have also been translated into English. They are also equipped with additional digital tools for self-preparation and testing of students' knowledge. Over 4,500 students have passed through the platform in 12 years. ELINSB has been built over almost two decades with the support of various national and European projects.

Over the past three years, under the

leadership of Prof. Dr. Anna-Maria Totomanova, the digital tools and resources of the infrastructure have been used and improved intensively in the SUMMIT project in the implementation of the following tasks:

1. Development of a digital dictionary of the translation of the Four Words Against the Arians, made by Constantine of Preslav in the early 10th century. For this purpose, a special converter was developed for processing dictionary articles, compiled in Word, and uploading them to the dictionary platform. The software of the Historical Dictionary of the Bulgarian Language, which is a constantly developing resource, was also upgraded and adapted.
2. Preparation of the edition of manuscript No. 105 from the library of the Zograf Monastery on Mount Athos, which is the autograph of one of the most famous Old Bulgarian writers, Konstantin Kostenechki. In its current form, the manuscript contains 293 leaves with numerous additions, glosses and liturgical notes in the margins, which make its reading with Transcribus practically impossible. For the study of the language and spelling of this important literary and historical document, a complete index of word forms was prepared with the help of specially developed software, which will subsequently be used to create a dictionary-index of the manuscript. The digital set of the manuscript is ready for printing, and will be uploaded to the Digital Corpus in due course.

### 3.1.16 ICT Applications for History And Language, Assoc. Prof. Dr. Maria Baramova / Prof. DSc Anna-Maria Totomanova, lead researchers

#### 3. Filling the Diachronic Corpus with new texts:

- The digitally typed text of the Four Words Against the Arians was processed and included in the corpus.
  - Another 40 manuscripts were digitally typed and prepared for processing.
4. Active work is underway on the digital dictionary of the Four Words Against the Arians. A special converter was developed for processing dictionary articles compiled in Word and uploading them to the Dictionary platform.
5. The BASTINA project is building a corpus of inscriptions and graffiti from the era of the Second Bulgarian Kingdom, which will be included in ELINIZB. For this purpose, the specialized Epidoc software was adapted to the UTF Old Bulgarian fonts CyrillicaBulgarian10U and CyrillicaOhrid10U, developed under previous projects, which are widely used by our colleagues in Europe and America. Recently, the CyrillicaOldStyle font, which is intended for the publication of manuscripts from the pre-modern era, has also been improved.

#### European dimensions:

1. The electronic services and tools of the Histdict System were included in the catalog of services of the European Research Network Resilience as an in-kind contribution of the Bulgarian participation

in it, and the e-Medievalia platform is part of the training program of the network.

2. Part of the texts of the Diachronic Corpus were used in the ITSERR (Italian Strengthening of the ESFRI RI RESILIENCE) project, funded under the Recovery and Resilience Plan of Italy, for the development of specialized tools for the study of the Slavic translation of the Creed.
3. A digital Checklist of 465 Greek manuscripts stored in the Ivan Duychev Central Library was developed, with dating and precise identifications of the works included in them, which will enhance the interest of researchers in the Byzantine heritage in Bulgarian lands.

By integrating advanced natural language processing tools with historical spatial analysis, the initiative fundamentally transforms the way researchers and students understand the complex cultural heritage of Southeast Europe. Furthermore, the project's commitment to creating open-access digital repositories of both medieval texts and archival documents represents a leap forward in preserving the region's deeply intertwined linguistic and historical identities of the region.



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### 3.1.7 Functional materials, Prof. Tony Spassov, lead researchers

14:00-18:00 - **Conference Hall, Rectorat**

16:00-16:30 Coffee break

Prof. Tony Spassov  
**Materials for hydrogen production and storage. Metal hydride-air batteries**

Prof. Spas Kolev  
**Development of polymer inclusion membranes and beads for separation in industry and chemical analysis**

Prof. Todor Dudev  
**Encapsulation of chemical substances by cyclodextrins. Host macrocycle's internal cavity hydration**

Prof. Stoyan Gutzov  
**Functional sol-gel composites**

Prof. Georgi Tsvetkov  
**Novel oxide nanostructures with diverse functionality**

Kalina Myashkova, R1  
**PIMs for extraction of thiocyanate and zinc ions**

### 3.1.7 Functional materials, Prof. Tony Spassov, lead researchers

The aim of this project was to develop functional micro- and nanostructured materials for applications in clean energy and environmental protection. The research focused on the synthesis of novel metal, polymeric, and composite materials designed for use as electrocatalysts in water electrolysis, sorbents for the removal of heavy metals and other pollutants from water, porous materials for the storage of gases and small molecules, and materials for hydrogen and electrical energy storage.

Within the project framework, a wide range of synthetic approaches was employed to produce metallic, inorganic, organic, and composite functional materials, supported by comprehensive structural and microstructural characterization. Particular attention was given to understanding the relationship between microstructure and functional performance. Quantum computational methods were integrated with experimental techniques to elucidate the mechanisms of various weak interactions. The scientific capacity of the research team, including both early-career scientists and experienced researchers, was substantially strengthened in the design and optimization of advanced functional materials. In addition, a distinguished international scientist with recognized achievements in environmental protection was engaged in the project.

The project generated significant scientific and applied outcomes, documented in numerous publications that have already attracted citations in the scientific literature. Key achievements include the development of membranes for solid-phase extraction of metals and anions; equipment for the simultaneous selective extraction of two metals; highly active catalytic materials for efficient hydrogen production and storage; optimized materials for negative electrodes in rechargeable batteries, particularly metal-hydride systems; nano- and microporous sorbents; porous sol-gel materials with potential applications in thermal insulation and water purification; and biodegradable filamentous chitosan with antibacterial and catalytic properties.

Overall, the project represents a substantial contribution to the advancement of functional nanomaterials with strong potential for environmentally sustainable technologies and the future of clean energy.



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### 3.1.3 GROWTH, Assist. Prof., MD Tsvetelina Velikova PhD., lead researcher

14:00-18:00 - **Auditorium 23, Rectorat**

16:00-16:30 Coffee break

#### Tsvetelina Velikova - **Final report**

Slavil Peykov, Evelina Manova, Tsvetelina Velikova, Dimitrina Miteva

**Development of an Integrative Approach to Identify Correlations Between Variations in Innate Immunity and Specific Microbiome Profiles in Patients with Inflammatory Bowel Disease (IBD)**

#### **Discussion**

Adriana Raykova, Tsvetelina Velikova, Latchezar Tomov

**Analysis of trends in mortality in Bulgaria 2000-2024**

Maria Kokudeva, Milena Gulinac, Tsvetelina Velikova, Georgi Momekov

**Strategies for drug repurposing in COVID 19**

### 3.1.3 GROWTH, Assist. Prof., MD Tsvetelina Velikova PhD., lead researcher

The GROWTH research group brings together experts from various fields of medicine and biology with a shared mission: to improve understanding, diagnosis, and treatment of immune-related diseases. The team's work spans a wide range of topics, including autoimmune and inflammatory conditions, COVID-19 and its consequences, reproductive health, and pediatric inflammatory syndromes.

One of the group's key activities focuses on biomarkers – measurable indicators that can support earlier diagnosis and more precise treatment. These efforts contribute to the development of personalized medicine, in which therapies are tailored to each patient's individual characteristics.

A major achievement of GROWTH is its research on multisystem inflammatory syndrome in children (MIS-C), a condition associated with COVID-19. The team established one of the largest national databases on MIS-C and developed practical diagnostic and treatment algorithms that can be applied in clinical practice. During the COVID-19 pandemic, the group conducted extensive analyses on virus transmission, vaccine effectiveness, and public attitudes toward vaccination. These findings are valuable not only for the scientific community but also for public health decision-making

and preparedness for future health crises.

In the field of reproductive health, GROWTH investigates the causes of reproductive failure and develops new therapeutic strategies. This work has direct relevance for many families facing challenges in achieving pregnancy.

Beyond scientific output, the project has had a strong societal impact. It has supported the training of young researchers, created opportunities for scientific career development in Bulgaria, and actively disseminated results through publications, conferences, and social media. Through its work, the GROWTH research group contributes not only to scientific progress but also to improving patient care and quality of life.



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### 3.2.3 New materials and photonics, Dr. Sotir Chervenkov, lead researcher

14:00-18:00 - **Auditorium 45, Rectorat**

16:00-16:30 Coffee break

M. Mincheva, L. Stoyanov, N. Dimitrov, M. Zhekova, A. Dreischuh  
**Single-shot polarization mapping of optical elements introducing spatially varying birefringence**

N. Dimitrov, M. Mincheva, L. Stoyanov, M. Zhekova, A. Dreischuh  
**Divergence of long-range Bessel-Gaussian beams with truncated coaxial rings**

M. Zhekova, M. Mincheva, L. Stoyanov, N. Dimitrov, A. Dreischuh  
**Tuning the output parameters of a femtosecond oscillator with an intracavity prism pair and an external sequence of chirped mirrors**

G. As, Georgiev, S. Balouchev, M. Bacheva  
**Induced surface polarization as unification concept between wettability theories: or from Nemann Equation of State towards van Oss-Chaudhury-Good theory for acid-base properties of liquid and polymer surfaces**

A. Zyapkov, K. Genkov, G. Tsutsumanova  
**Formation of 2D metal microparticles arrays by electron-beam dewetting**

Zh. Kiss'ovski, I. Ivanov, S. Marinov, V. Vachkov, G. Popov, M. Eneva, P. Tsonev, D. Georgieva, H. Yordanov  
**N-graphene/SiC composite as Epsilon Near Zero metamaterial**

M. Georgieva, D. Tzankov, D. Kovacheva, V. Tumbalev, T. Karadimov and P. A. Georgiev  
**Magnetic and Structural Tuning of Nanocrystalline Ni-Zn Ferrites with Varying Compositions and Heat Treatment**

V. Donchev, K. Kirilov, M. Milanova, P. Ralova, K. Genkov, G. Tsutsumanova, P. Elenkin  
**Study of GaSb Micro-islands Deposited on Si Substrates with Au Catalytic Nanoparticles**

V. Ivanov, B. Slavchev  
**High-precision atomistic calculations for modeling of molecular and solid-state materials**

M. Mladenova, A. Philkina, S. Shishkov, L. Petrov, I. Buchvarov  
**Chirped Pulse Amplification and Thermo-Optical Characterization of Yb:CALYGLO for High-Average-Power Ultrafast Laser Systems**

I. Buchvarov  
**The Net-Gain Bandwidth Broadening in Yb-Doped Laser Amplifiers: A Breakthrough for Generating High-Energy Ultrashort Pulses and Their Applications**

### 3.2.3 New materials and photonics,

**Dr. Sotir Chervenkov**, lead researcher

Photonics is a broad field in physics and engineering that deals with methods for generating light (a stream of photons), the modes of its propagation (linear and nonlinear), the modulation, detection, and processing of optical information, as well as the principles, materials, and technologies required for the creation of laser emitters, receivers, and propagation media.

Photonics is inextricably linked to the properties of materials, and the relationship is bidirectional. On the one hand, optical methods across the entire spectrum—from microwave to X-ray radiation—are the most widely used and precise methods for investigating the structure and properties of materials. On the other hand, to generate light with precisely defined properties and to achieve precise control over its propagation modes, materials with predetermined characteristics are required.

Photonics and materials science are among the most rapidly developing scientific disciplines and technological fields. The relevance of research in the field of photonics and the creation of new materials, as well as its intensity on a global scale, are easily recognizable by the vast number of publications in specialized scientific journals, as well as by the large number of Nobel Prizes awarded in these fields over the past two decades.

Photonics and new materials are not only an integral part of scientific research but also play a leading role in cutting-edge technologies, which are becoming increasingly widespread and are used in applications spanning medicine (diagnostic imaging, ophthalmology,

non-invasive surgery, etc.), microbiology (ultra-high-resolution microscopy), microelectronics, communication technologies, quantum computing and information processing, microsensors, green energy sources (photovoltaics), etc. In this broad field, the research program focuses on topics grouped into six work packages, covering the following areas: linear and nonlinear photonics, development of laser amplifiers based on innovative ytterbium (Yb) crystals, enabling the generation of high-power short laser pulses, investigation of insulator-to-metal laser transitions, structuring of ultrashort optical pulses via metasurfaces, Raman spectroscopy for characterizing geological samples, industrial materials, artifacts, etc.; development and characterization of materials for sensor applications; creation and characterization of metamaterials for the microwave range; magnetic and microstructural optimization of nanocrystalline Ni-Zn ferrites, which is important for modern functional materials, development of cutting-edge optical technology for minimally invasive determining the temperature and oxygen concentration in cells, studying materials and optimizing their properties for applications in photovoltaic cells, developing an interactive software application for calculating the electronic structure of atoms from first principles, studying nanotubes and the development of an approach for determining surface energy based on the measurement and analysis of contact angles of microliter droplets on polymer and other solid surfaces, as well as the improvement of the wettability of contact lenses, and Fabry-Perot microscopy.



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## Poster session for the 3.4 Groups

All day

Central lobby, Rectorat



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Assoc. Prof. Yonka Parvanova

**Selection and qualification of headteachers of educational institutions in the system of pre-school and school education**

Assoc. Prof. Ivanka Tsacheva

**Selection of high affinity recombinant scFv antibodies against human complement proteins and human Galectin-3**

Assoc. Prof. Hristomir Yordanov

**Characterization of the Conductivity of Biocompatible Polymer Based 3D-Printable Compound Filaments at 10 GHz**

Assoc. Prof. Dr. Stoycho P. Stoychev

**Impact of Electoral Reforms on Voter Participation in Bulgaria and the EU (2021-2024)**

Assoc. Prof. Elena Tasheva-Terzieva

**Zoological Collection Of Sofia University "St. Kliment Ohridski": Past And Present**

Assoc. Prof. Silvena Boteva

**Assessment Of The Effects Of Conservation Activities Implemented In The Cirque Of The Seven Rila Lakes**

Prof. D.Sc. Neviana Krasteva

**Gamification In Education And The Workplace**

Prof. Ivayla Pantcheva

**Diverse chemistry of polyether ionophores**

Assoc. Prof. Valentina Ganeva

**Extraction of Bioactive Compounds from Yeast by Combining Pulsed Electric Field Treatment and Enzymatic Hydrolysis**

Assoc. Prof. Vihra Naydenova, PhD

**Influence of Psychological and Social Factors on Work Engagement and Well-being in Organizational Context**

**Digitalization and Social Support in Organizational Context: First Empirical Results**

## Poster session for the 3.4 Groups

All day

Central lobby, Rectorat

Assoc. Prof. Galina Georgieva, PhD

### **Algorithm Literacy: Socio-pedagogical Aspects**

Assoc. Prof. Kalin Kalinov, PhD

### **The Algorithms Hidden Political Weapon During The 2024 US Presidential Election**

Prof. Sonia Ilieva

### **Reactivity in Friedel-Crafts Aromatic Benzylolation The Role of the Electrophilic Reactant**

Prof. Iliana Ivanova

### **Biological Activity Of Sol-gel-derived Silica Nanomaterials**

Assoc. Prof. Peicho Petkov

### **Complex Systems Modelling**

Assoc. Prof. Dr. Boyan Lomev

### **Markov Regime-Switching Modeling of Passenger Flow in a Suburban Area Based on Anonymized Telecommunications Data**

Assoc. Prof. Bilyana Rangelova

### **Methodological Framework And Structure Of An Adapted Training And Educational Model In Swimming For Students With Special Educational Needs**

Assoc. Prof. Albena Taneva, PhD

### **The Importance Of Shared Society In A Disrupted World**

Prof. George Boiadjiev

### **Handheld robotized system for automatic bone drilling in the orthopedic surgery**

Assoc. Prof. Aleksandar Dimov, PhD

### **Artificial Intelligence and Big data for Education, Software and information Technologies**

Assoc. Prof. Violeta Kotseva, PhD

### **Bulgarian Sunday Schools Abroad Between National Education and New Contexts**

Assoc. Prof. Dessislava Lazarova

### **Verification of a new redox-sensitive contrast probe for visualization and**



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## Poster session for the 3.4 Groups

All day

Central lobby, Rectorat

### **evaluation of redox state and oxidative stress in biological objects through magnetic resonance techniques**

Assoc. Prof. Reneta Raykova

### **Investigation of the focal mechanisms of earthquakes with magnitude $M \geq 4$ on the territory of Bulgaria and its surroundings**

Prof. Ivayla Popova, PhD

### **Shared Academic Spaces Research on the impact of shared academic spaces on student motivation and achievements**

Prof. Dsc Mira Tzvetkova-Arsova

### **Use of technology and applications in orientation and mobility of visually impaired persons in Bulgaria**

Prof. Dsc Mira Tzvetkova-Arsova

### **Accessibility of Braille Texts for the Visually Impaired Produced with Different 3D Printing Technologies**



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22 April 2025

# PROGRAM

## 22 April



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22 April 2025

<b>Lunch break</b>	
<b>22 April</b> 12:00-14:00	<b>"Alma Mater"</b> restaurant

<b>Coffee break</b>	
<b>22 April</b> 10:30-11:00 16:00-16:30	<b>Central lobby</b> – for the groups in Hall 1, Hall 2 and the Egg. <b>South Wing lobby</b> – or the groups in Auditoriums 23, 45, 63 <b>In front of the Conference Hall</b> – for the group inside



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### 3.1.9 GAMMA, Prof. Dr. Sc. Mladen Savov, lead researcher

9:00-13:00 - **Hall 1, Rectorat**

10:30-11:00 Coffee break

Mladen Savov  
**Overview of the activities of the GAMMA group with an emphasis on financial mathematics**

Hristo Sariev  
**Exchangeable measure-valued Pólya sequences**

Karol Szczypkowski  
**Semigroups under resetting,**

Kacper Budnik  
**Semigroups under resetting and repulsion**

Dean Palejev  
**Multiple testing procedures under dependency assumptions**

Nikolay I. Nikolov  
**Reliability properties of k-out-of-n systems with several cold standby units**

Michał Gutowski  
**Trapping effect of stable processes**

Ronnie Loeffen  
**Fluctuation theory of skip-free downward Markov chains and spectrally positive Markov processes**

Martin Minchev  
**Asymptotics of beta-splitting trees via extended meromorphic subordinators**

### 3.1.9 GAMMA, Prof. Dr. Sc. Mladen Savov, lead researcher

Stochastics studies randomness and uncertainty—phenomena that manifest themselves everywhere around us, from financial markets and medical data to engineering and digital technologies. The GAMMA research group at the Faculty of Mathematics and Informatics of Sofia University “St. Kliment Ohridski” plays a leading role in the development of this field in Bulgaria, while at the same time strengthening national research capacity and contributing to the advancement of stochastics internationally.

GAMMA's work combines fundamental research with applications. The group has achieved significant results in applied stochastics, statistics, and data analysis. Its members develop effective methods for the pricing of financial instruments and for risk assessment, supporting more reliable decision-making under uncertainty. GAMMA also develops statistical methods for the analysis of large data sets, with applications in genetics and biomedicine, including the more precise identification of genes associated with disease. At the same time, the group develops new mathematical models for random phenomena that are not adequately described by existing methods and that find applications in physics, biology, engineering, and finance, where processes are often especially complex and dynamic. The results of GAMMA's fundamental research are diverse, but they gravitate around the study of fractality, which is consistently observed in nature. Connections between different areas of mathematics have also been established and successfully exploited.

Beyond its research activities, GAMMA has a lasting impact on the scientific and educational environment in Bulgaria. The group brings together established scholars, early-career researchers, and international specialists, thereby sustaining a strong Bulgarian presence in stochastics. Within the framework of the project, its members publish in prestigious scientific journals, participate in major international forums, and collaborate with numerous researchers from abroad. Through initiatives such as the organization and funding of the 11th International Conference on Lévy Processes, GAMMA also contributes to the international visibility of Bulgarian science. The group also plays an active role in education and the popularization of science. Its members create opportunities for more advanced training in stochastics in response to the growing need for expert knowledge in data analysis and artificial intelligence. At the same time, GAMMA engages students and younger audiences through lectures and seminars, fostering interest in mathematical modelling and quantitative thinking.

The work of the group has generated numerous internal and international collaborations, laying a solid foundation for the future development of stochastics in Bulgaria. This development responds both to the growing role of artificial intelligence and data analysis and to the need for a competent and broad teaching body. Indeed, building such a foundation for the future was one of the main goals behind the formation of the group and the use of its resources.



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### 3.1.2 Active formulation and materials,

Prof. Slavka Tcholakova, lead researcher

14:00-18:00 - **Hall 1, Rectorat**

16:00-16:30 Coffee break

S. Tcholakova

**Summary of the main scientific results obtained by research group "Active formulations and materials" during the third year of the project**

#### Discussion

Z.Vinarov

**Predicting the agitation stability of monoclonal antibodies**

by Z. Vinarov, M. Cohrs, N. Pagureva, U. Ozbulak, W. De Neve, K. Braeckmans, S. De Smedt, S. Tcholakova, H. L. Svilenov

L. Vinarova

**Drug Solubilization in Simulated Intestinal Fluids vs Lipophilicity: Does Charge Matter?**

by L. Vinarova, T. Boyanov, Ch. Tistaert, J. Bevernage, Z. Vinarov, S. Tcholakova

Z. Mitrinova

**Effect of cyclic molecules on mixed surfactant systems salt curves**

by Z. Mitrinova, N. Pagureva, N. Burdzhiev, S. Tcholakova

D. Gazolu-Rusanova

**Role of food additives on properties of Polysorbate 60 solutions**

by D. Gazolu-Rusanova, Z. Mitrinova, N. Pagureva, N. Burdzhiev, S. Tcholakova

B. Petkova

**The role of hydrogen bonds in foam stabilization at low surfactant concentrations**  
by B. Petkova, S. Tcholakova

I. Lesov

**Role of interactions between hydrophilic sugar esters and sugar for the preparation of food emulsions and foams**

by I. Lesov, S. Tcholakova

N. Pagureva

**Sucrose monolaurate self-assembly via hydrogen bonding: Role of surfactant concentration and urea**

by N. Pagureva, F. Mustan, D. Cholakova, N. Burdzhiev, A. Ivanova, S. Tcholakova

F. Mustan

**Computational modeling of the early-stage solubilization of a fenofibrate aggregate into mixed bile salt and fatty acids micelles**

by F. Mustan, A. Ivanova, S. Tcholakova

S. Iliev

**Studying the solubilization of perfume molecules in mixed surfactant micelles with molecular dynamics**

by S. Iliev, F. Mustan, N. Pagureva, S. Tcholakova

### 3.1.2 Active formulation and materials,

**Prof. Slavka Tcholakova**, lead researcher

Every day, we use shampoos, laundry detergents, and cleaning products without realizing that they exist thanks to surfactants. These are the substances that allow foam to stay stable and enable medicines to reach the exact spot in our bodies where they are needed. Today, the world consumes over 18 billion tons of surfactants annually. The problem is that a large portion of them are petroleum-based and difficult to break down, persisting in nature for years, or even decades.

The research group "Active Formulations and Materials" is working to replace these petroleum-based ingredients with entirely eco-friendly and biodegradable alternatives produced by renewable raw materials like sugars, oils, and amino acids. We aren't just searching for new substances—we are creating a scientific platform that allows the industry to quickly and easily replace petroleum-based surfactants with biodegradable ones without compromising product quality. Our research answers key questions: how a molecule's structure affects foam stability, what ingredients are needed to create high-quality eco-cosmetics, and how to stabilize drug molecules.

Our work over the past period has transformed theoretical models into real-world value:

- **Scientific achievements:** We have published 21 articles in the world's most prestigious journals and presented our results at over 40 international forums in France, UK, USA, Canada, and beyond. We are preparing 15 more articles based on the results obtained in the

project.

- **Investing in the Future:** We attracted and trained over 30 young scientists and students (including international interns from France), cultivating a new generation of experts in eco-friendly and biodegradable surfactants.
- **European Funding:** During this period, we contributed to the preparation of two large-scale international projects approved for funding under the "Horizon Europe" program, focusing on sustainable bio-based products and innovative materials.
- **Global Recognition:** We signed over 20 collaboration agreements with international companies. This ensures that our discoveries can successfully reach the end consumers.

The ultimate goal of our work is a world where:

- **Nature is Cleaner:** Used detergents biodegrade completely without polluting rivers and soils.
- **Products are Safer:** Cosmetics and medicines become gentler on human health, thanks to the natural origin of their ingredients.
- **The Economy is Sustainable:** We reduce dependence on oil and help businesses transition to "green" technologies faster and more cost-effectively.

In short, we are building the bridge between complex molecules and everyday products to ensure that progress does not come at the expense of the environment.



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### 3.1.14 Nuclear, Assoc. Prof. PhD, Krasimir Mitev, lead researcher

9:00-13:00 - **Hall 2, Rectorat**

10:30-11:00 Coffee break

K. Mitev

#### Opening meeting

Kalin Gladnishki

**WP1: Report on the Activities of Research Group "Nuclear" (WPI) for the Entire Duration of the "SUMMIT" Project**

Stefan Lalkovski, PhD

**WP2: Nuclear data - A status report**

Krasimir Mitev, PhD

**WP3, Advances in radon dosimetry with electronic detectors and radionuclide metrology**

Dobromir Pressyanov

**WP4, New directions for scientific research and applications, marked out by the results of WP 4" author:**

M. Bogomilov

**WP5.1., European Spallation Source Neutrino Super Beam: Status and Prospects**

K. Kostova

**WP5.2., Searching for new particles with PADME**

### 3.1.14 Nuclear, Assoc. Prof. PhD, Krasimir Mitev, lead researcher

The Nuclear group has implemented an interdisciplinary research program that combines fundamental studies and applied developments in the field of nuclear and sub-nuclear physics.

In the area of nuclear structure, new experimental data have been obtained for a wide range of atomic nuclei, including collective effects, electromagnetic transitions, and symmetries in nuclear dynamics. These results support the development of theoretical models with applications in nuclear energy, medicine, and radiation protection. Our active participation in international research infrastructures enhances our capacity for knowledge transfer and integration into the global scientific community.

Contributions with direct societal relevance have been achieved in the radon research. The feasibility of using electronic radon detectors for reliable long-term measurements in homes and workplaces was demonstrated. A new method has been developed to determine the strength of the sources of indoor radon through time-series analysis. Novel highly sensitive passive method for radon detection and novel method for determining radon/thoron exhalation from surfaces were developed. Metrological standards and patented devices for measuring radon in air and water have been established, improving the traceability and reliability of measurements. These results enable more accurate risk assessment and better protection against radon exposure.

The studies in the field of sub-nuclear physics, aim at addressing fundamental questions as: what is the nature of dark matter? Is it composed of heavy or light particles? How to detect its manifestations on Earth? Significant results have been achieved in the search for new particles and the study of high-energy interactions. Innovative detector technologies and data analysis methods, including those based on machine learning, were developed. Within the PADME experiment, new constraints were set on the properties of possible light particles related to dark matter. In parallel, studies on the formation of hadrons and light nuclei contribute to a better understanding of processes of cosmological importance.

These developments have broad potential applications beyond fundamental science, including in big data processing and the development of high-tech systems. In summary, the project generates sustainable scientific and socio-economic value through innovation, technologies for improving public health, and the training of highly qualified specialists. A total of 19 researchers participated in the Nuclear group, publishing 71 papers indexed in Web of Science over the course of the project and filing two international patents. Part of the results has been published in high-impact journals such as Nature, Building and Environment, Journal of High Energy Physics, and Physical Review D, among others.



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### 3.1.12 Intelligent systems, Prof. Ivan Koychev, lead researcher

14:00-18:00 - **Hall 2, Rectorat**

16:00-16:30 Coffee break

Ivan Koychev

#### Research group presentation

Georgi Grazhdanski, Vasil Vasilev, Sylvia Vassileva, Dimitar Taskov, Izabel Antova, Ivan Koychev, Svetla Boytcheva

**SynthMedic: Utilizing large language models for synthetic discharge summary generation, correction, and validation.**

Sylvia Vassileva, Ivan Koychev, Svetla Boytcheva  
**Evaluating LLMs' Performance on Toxic Habit Extraction in Spanish Clinical Texts.**

Sylvia Vassileva, Ivan Koychev, Svetla Boytcheva  
**Using LLMs for Multilingual Clinical Entity Linking to ICD-10.**

Boris Velichkov, Aleksis Datseris, Sylvia Vassileva, Svetla Boytcheva

**Enigma@ EICardioCC: Bridging NER and ICD-10 entity linking-A hybrid method for Greek clinical narratives.**

Maria Nisheva-Pavlova, Alexandrina Karakehayova, Kristian Atanasov, Evgenia Miltenova-Haralampieva

#### Automatic Analysis of News Texts

Valentina Terzieva, Boyan Bontchev  
**Methodology for Declarative Description and Automatic Generation of Adaptive Personalized Educational Video Games**

Hristo Ivanov, Boyan Bontchev

**A Model of Intelligent Dynamic Adaptation of Difficulty in Educational Video Games**

Radina Panayotova, Boyan Bontchev

**A Taxonomy for NPCs in Educational Video Games.**

Blagoy Anastasov, Boyan Bontchev

#### Personalization of Content in Serious Games Through Psychological Characteristics

Stefan Petrov, Ivan Koychev

**Removal of Compression Artifacts from JPEG images**

Dimitar Dimitrov

**SemEval 2025 Task 10: Multilingual Characterization and Extraction of Narratives from Online News**

Dimitar Dimitrov

**SlavicNLP 2025 Shared Task: Detection and Classification of Persuasion Techniques in Parliamentary Debates and Social Media,**

Dimitar Dimitrov

**Overview of ImageCLEF 2025 – Multimodal Reasoning**

Ivo Moravski, Dimitar Dimitrov, Ivan Koychev

**Generic-Level Narratives Classification Scheme.**

Nikolay Ribin, Dimitar Dimitrov, Ivan Koychev

**Persuasion Technique Detection in Bulgarian**

Boris Velichkov

**Development of intelligence tools for the Bulgarian National Radio Archive.**

Boris Velichkov

**Knowledge management in the intelligence system research group**

Ivan Koychev

**Discussion of future research directions.**

**Closing**



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**3.1.6 BAC, Prof. DSc Ivo Grabchev, lead researcher**

9:00-13:00 - **The Egg Conference Hall, Rectorat**

10:30-11:00 Coffee break



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Prof. Ivo Grabchev

**Bioactive compounds. Annual report**

Assoc. Prof. Stanimir Stoyanov

**Naphthalimide Derivatives with  
Extended Heterocyclic Systems—  
Synthesis, Spectral and Sensing  
Properties**

Assoc. prof. Assja Tzanova

**Study of the molecular mechanism of  
action of newly synthesized peptide  
angiotensin (Ang) and its derivatives on  
model membrane systems**

Prof. Albena Jordanova

**Biophysical and cytological studies to  
establish the mechanism of action of  
dendrimers with proven antimicrobial  
activity**

Prof. Ylian Zagraniarski

**Benzodioxin- and Benzofuran Fused  
Naphthalimides as Antitumor Agents**

### 3.1.6 BAC, Prof. DSc Ivo Grabchev, lead researcher

#### **Invisible Allies: The Role of Bioactive Compounds in Human Health**

In the world around us, an ongoing invisible battle is constantly taking place—between the human body and microscopic enemies such as pathogenic bacteria, viruses, and cancer cells. In this battle, some of our most powerful allies are bioactive compounds—small molecules with a profound impact on medicine and human health.

Today, as antibiotic resistance becomes a global challenge, viruses spread rapidly, and cancer remains a leading cause of mortality, the need for new and more effective compounds is greater than ever. Scientists around the world are therefore actively searching for, designing, and studying novel molecules that have the potential to save lives. This is precisely the focus of our research team. Using modern chemical approaches, we synthesize new compounds that do not exist in nature and investigate their properties. This is not merely laboratory work—it is the creation of potential future medicines. Some of these compounds are capable of destroying bacteria, including strains resistant to commonly used clinical antibiotics. Others exhibit antiviral activity by inhibiting viral replication within cells. Particularly promising are compounds with antitumor properties, which can selectively target cancer cells while sparing healthy tissues. Some of the developed compounds are activated by light—the basis of photodynamic therapy. Upon irradiation, they generate reactive oxygen

species that effectively destroy pathogenic microorganisms. This enables a more precise and less invasive therapeutic approach. These scientific advances also translate into real-world applications. Antibacterial and self-disinfecting textiles have been developed, in which active compounds are embedded directly into the fabric. When exposed to light, these materials can eliminate bacteria and prevent the formation of harmful biofilms. This opens new possibilities for safer medical clothing, wound dressings, and protective materials. In addition, some of the synthesized compounds can function as sensors, capable of detecting harmful substances or environmental changes, making them valuable not only in medicine but also in environmental protection and industry.

Behind every new compound lie years of work, dozens of experiments, and careful analysis. From the initial idea to potential application, the journey is long, but every new molecule represents a step forward toward better diagnostics, more effective treatments, and a healthier society.

The search for new bioactive compounds is not just a scientific endeavour - it is an investment in the future. And although these molecules are invisible to the human eye, their impact can be truly transformative.



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### 3.1.4 Advanced Quantum and Optical Technologies (AQOT), Prof. DSc Asen Pashov, lead researcher

14:00-18:00 - **The Egg Conference Hall, Rectorat**

16:00-16:30 Coffee break

Nikolay Vitanov  
**Overview of Work Packages 1-3**

Kaloyan Zlatanov  
**Two-qubit gate for Rydberg ions**

Ivo Mihov  
**Pulse shape effects in qubit control**

Stanko Stanchev  
**Quantum process tomography**

Branislav Ilic  
**New concepts in Ramsey spectroscopy**

Hristo Tonchev  
**Composite quantum gates**

Simona Grigorova  
**Characterization of quantum Toffoli gate**

Nayden Nedev  
**Topological dynamical decoupling**

Aida Shiroyan  
**Methods for calculating qubit dynamics**

Julian Dimitrov  
**Optimization of multistate STIRAP**

Andon Rangelov  
**Arbitrary polarization retarders and polarization controllers, constructed from sequences of half-wave and quarter-wave plates**

Asen Pashov  
**Adiabatic and adiabatic treatment of molecular states**

Peter Ivanov  
**Quantum simulation of ergodic quantum systems**

Venelin Pavlov  
**Probing the ergodicity breaking transition via violations of random matrix theoretic predictions for local observables**

Joanna Chorbadzhiyska  
**Analytical determination of multi-time correlation functions in quantum chaotic systems.**

Bogomila Nikolova  
**Adiabatic Ramsey Interferometry for Measuring Weak Nonlinearities with Super-Heisenberg Precision**

Yavor Yordanov  
**Full Random Matrix Approach to Observable Correlation Functions**

### 3.1.4 Advanced Quantum and Optical Technologies (AQOT),

**Prof. DSc Asen Pashov**, lead researcher

Imagine that you can control individual atoms and particles of light with such precision that you can build a computer millions of times more powerful than today's. Or a sensor that captures magnetic fields that have been invisible to science until now. Scientific group 3.1.4 "Modern Quantum and Optical Technologies" at Sofia University, led by Professor Nikolay Vitanov, is dealing with exactly such challenges.

#### What does the group do?

The work is based on a simple but extremely difficult idea: how to control the behavior of quantum systems - the smallest building blocks of matter. In the ordinary world, if we want to move an object, we simply grab it and put it in a new place. However, in the quantum world, things are fundamentally different - particles obey their own laws, unknown to our everyday lives. The team is developing different methods to control these particles: slowly and smoothly (adiabatic control), through a series of precise impulses (composite pulses), or with other methods refined with the help of artificial intelligence (machine learning).

Why is this control so important? Because any error in controlling a quantum particle accumulates and can fail the entire calculation. The group has achieved remarkable results in creating extremely precise quantum operations - the so-called quantum gates. They are the basic building blocks of a quantum computer, similar to transistors in ordinary computers. Many of these new methods have already been experimentally verified on real IBM quantum processors.

#### Measuring the invisible

Another main direction of research is quantum sensors - the use of quantum effects to measure weak electric and magnetic fields, temperatures and other physical quantities with unprecedented accuracy. The team showed how certain quantum

states overcome fundamental limitations that were previously considered absolute. One of the most impressive achievements is the demonstration of so-called "super-Heisenberg precision" - precision beyond the theoretical limit previously considered absolute in quantum physics.

#### Molecules and light

Part of the team studies the behavior of molecules when interacting with laser light. This research helps to better understand the internal structure of substances and has potential applications in chemistry and pharmaceuticals - for example, for recognizing the "left" and "right" forms of the same molecule, which is critically important in drug development.

In parallel, the group developed new optical devices for controlling the polarization of light - innovative tools applicable in telecommunications, laser technology and scientific measurements.

#### Why is this valuable for society?

Quantum technologies are not distant fiction - they are already changing the world. Quantum computers promise to accelerate the development of new materials and drugs. Quantum sensors will help with medical diagnostics with unprecedented sensitivity. Quantum cryptography will provide communications that are impossible to eavesdrop on.

The group has published 37 scientific articles in prestigious international journals, organized three scientific conferences and contributed to the establishment of the Center for Quantum Technologies at Sofia University. This puts Bulgaria on the map of global quantum science and prepares the next generation of scientists in one of the most promising fields of knowledge.



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### 3.1.10 DigitalEdu-SU, Prof. Dr. Roumiana Peytcheva-Forsyth, lead researcher

9:00-18:00 - **Conference Hall, Rectorat**

10:30-11:00 Coffee break; 12:00-14:00 Lunch break "Alma Mater" restaurant; 16:00-16:30 Coffee break



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#### DIGITALIZATION IN BULGARIAN EDUCATION

##### I – session

Prof. Roumiana Peytcheva-Forsyth

**Opening of the Conference and Presentation of the Three-Year Study on the State of the Digitalisation of Bulgarian Education**

Assoc. Prof. Bistra Mizova

**The Digital Maturity of the Bulgarian School: From Strategic Management to Pedagogical Reflection**

Assoc. Prof. Blagovesna Yovkova

**Development of Digital Competences among Student Teachers, Practising Teachers, and School Students**

Assoc. Prof. Bistra Mizova

**The Digital Professional Development of Bulgarian Teachers between Educational Policies and Pedagogical Realities**

Prof. Vasya Delibaltova

**The Use of Digital Technologies in Assessing Learning Progress and Outcomes in Secondary Education**

##### Discussion

##### II session

Assoc. Prof. Veronica Racheva and  
Assoc. Prof. Lyubka Aleksieva

**THE STATE OF DIGITALISATION IN PRIMARY EDUCATION: FROM CURRICULUM DOCUMENTATION TO PEDAGOGICAL PRACTICE**

Assoc. Prof. Iva Georgieva, Assoc. Prof. Elena Boyadzhieva,  
Assoc. Prof. Maya Gaidarova, Assoc. Prof. Isa Hadzhiali,  
Doctoral Researcher Martina Tsenova

**THE STATE AND TRENDS OF DIGITALISATION IN SCIENCE EDUCATION IN SECONDARY AND HIGHER EDUCATION**

Dr Irena Dimova

**INTEGRATING DIGITAL TECHNOLOGIES INTO FOREIGN LANGUAGE TEACHING IN SECONDARY EDUCATION**

Assoc. Prof. Nikolina Nikolova and  
Assoc. Prof. Temenuzhka Malcheva

**POLICIES, PRACTICES AND PERSPECTIVES: DEVELOPING DIGITAL COMPETENCES IN BULGARIAN EDUCATION IN THE FIELDS OF MATHEMATICS, INFORMATICS AND INFORMATION TECHNOLOGIES**

Assoc. Prof. Maya Vassileva and  
Dr Katya Misheva

**DEVELOPING DIGITAL COMPETENCES IN SOCIAL SCIENCE EDUCATION: CHALLENGES AND PERSPECTIVES**

Panel Discussion:

**ARTIFICIAL INTELLIGENCE IN THE CONTEXT OF DISTANCE EDUCATION – PROBLEMS AND SOLUTIONS**

### 3.1.10 DigitalEdu-SU,

**Prof. Dr. Roumiana Peytcheva-Forsyth**, lead researcher

The digital transformation of education represents one of the most significant developments and, at the same time, a major challenge for contemporary societies, as it affects the very core of education – its content, its methodology, and its educational aims and outcomes. Despite significant investments in technology and the availability of strategic documents, there is a discrepancy in Bulgaria between available resources and their actual pedagogical application, as well as a lack of clarity on how digital competencies are formed in practice.

These are the questions that form the basis of the research of the DigitalEdu-SU research group within the framework of the SUMMIT project of Sofia University “St. Kliment Ohridski” with leading researcher Prof. Romyana Peycheva-Forsyth. In this context, the research group implemented a three-year national study aimed at establishing the real state of digitalization in Bulgarian education.

The study covers both the preparation of students-future teachers and actual pedagogical practice in schools. Through a mixed research design including national surveys, interviews, lesson observations and analysis of educational documentation, a comprehensive picture of how digital technologies are used in teaching, learning and assessment has been created.

The first phase of the study involved lecturers and students-future teachers from Sofia University, while the second phase involved a national survey in 359 schools with over 2,400 teachers, 370 principals, 1,245 students and 677 parents, complemented by an in-depth qualitative study in 30 schools. This makes the study the largest-scale study of the digitalization of education in Bulgaria to date.

The main results show that digital technologies are already a natural part of the educational environment. Teachers use them actively in their daily work, and students have basic digital skills. However, there is a discrepancy between teachers’ stated intentions to use technologies and their actual application in the classroom. Teachers state that they use technologies for active learning and skill development, but in practice they most often serve to present content, rather than to engage students in independent and creative work.

The study also shows that the presence of a good technological infrastructure is not a sufficient condition for quality digitalization of education. Pedagogical practices, teacher training and strategic leadership at the school level play a key role. The analysis of curricula highlights the need for a clearer conceptual framework for digital competences, and the study of university preparation shows the need for better integration of digital technologies into pedagogical and methodological disciplines for teachers’ preparation.

The project contributes to the development of the scientific capacity of Sofia University by creating an active research community and significant publication activity - over 55 scientific publications, including over 20 in international indexed journals. In this way, the activity of the scientific group is positioned in the international scientific context and contributes to the global debate on the digitalization of education.

The results of the study provide a reliable basis for decision-making and will be used to develop recommendations to the Ministry of Education and Science, universities and schools for a more effective and sustainable digital transformation of education.



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**3.1.17 SMEs digitalization, Prof. Dr. Desislava Yordanova, lead researchers**

9:00-13:00 - **Auditorium 23, Rectorat**

10:30-11:00 Coffee break

Vladimirov, Z., Mladenova, I., Harizanova, O.

**The gendered landscape of digital technology adoption in SMEs: A systematic synthesis of patterns**

B. Pelova, D. Sotirova

**Data Quality Assurance in Social Media Research: Why Human-in-the-Loop Matters? Empirical Evidence from a Study of SMEs in Bulgaria**

N. Netov, K. Spassov

**Digital Transformation in Transport**

Pergelova, A., Yordanova, D., Manolova, T.

**Digital Culture and SME Performance: The Gendered Effects of Value Co-Creation**

### 3.1.17 SMEs digitalization, Prof. Dr. Desislava Yordanova, lead researchers

The research program of the scientific group „Digitalization of SMEs“ aimed to reveal the degree of digitalization of SMEs in Bulgaria and its effect on their competitiveness. SMEs in Bulgaria play important role in the economy representing more than 98% of all enterprises and having a significant contribution to employment, value added, and total export of the country (EASME, 2024). The realization of this aim included the performance of the various tasks, grouped into five work packages.

The members of the research group published articles in scientific journals and international scientific conference proceedings, indexed in Web of Science. They participated in various national and international research scientific conferences. Assoc. prof. d-r Boryana Pelova and chief assist. prof. d-r Gloria Hristova won the prizes „Best oral presentation DMI 2024“ and „Best oral presentation DMI 2025“ during Third and Forth international scientific conference on digitalization and innovation management (DMI 2024, 2025). The paper titled „The Human Element in Digital Transformation: The Role of Talent Management for SMEs“ authored by prof. d-r Albena Pergelova and prof. d.sc. Desislava Yordanova received a nomination for Best Paper Award during 68th ICSB World Congress in Berlin, Germany.

The results revealed that the existence of digital strategies by themselves may not lead to improved performance unless they are well integrated with the appropriate talent management practices that support

organizational agility. Various ways in which digital technologies affect organizational performance and internationalization of SMEs are outlined. The main thematic focuses in the research on digital transformation in family business are presented. It is proved that the company size and the educational level of entrepreneur/manager contribute significantly to the SMEs digitalization. Other results suggest that SMEs managers must develop a digital orientation to remain competitive in the digital economy. The mediating role of organizational factors (top management support and digital strategy) between environmental factors and digital transformation and firm performance. The need to shape a culture that tolerates risk and promotes digital transformation was highlighted. The paths for the implementation of digital technologies in man- and women-led SMEs are revealed.

A conceptual framework based on machine learning methods and artificial intelligence for knowledge extraction and analytical processing of unstructured data is developed. A framework for developing an index of digital transformation of SMEs in different sectors based on consumer preferences from publicly available online sources is provided. A methodology which uses data from social media for extracting and summarizing customer attitudes and emotions and thus complements traditional indicators of digitalization effectiveness is presented



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### 3.2.1 NATATA, Prof. Bojan Popov Ph.D., lead researcher

14:00-18:00 - **Auditorium 23, Rectorat**

16:00-16:30 Coffee break



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#### **Numerical analysis and applications, approximation theory and applications**

Bojan Popov

#### **Maximum speed of propagation in a Riemann problem with a convex equation of state**

Borislav R. Draganov and Ivan Gadjev  
**Approximation by exponential-type operators in variable exponent Lebesgue spaces**

Geno Nikolov

#### **On certain new inequalities for real-root polynomials**

Ivan Gadjev, Parvan Parvanov, Rumen Uluchev

#### **On a new Goodman-Sharma type modification of the Meyer-König and Zeller operator for approximation of $C[0,1]$ functions with rate of approximation $O(n^{-2})$**

Maya Stoyanova

#### **Some new bounds on the covering radius of orthogonal arrays of even strength**

Borislava Konstantinova, Geno Nikolov  
**On the Regularity of Certain Three-Row Almost Hermitian Incidence Matrices**

Georgi Bazlyankov

#### **Some properties of special solutions for a chemotaxis system with logistic source**

### 3.2.1 NATATA, Prof. Bojan Popov Ph.D., lead researcher

The activity of the research group 3.2.1 “Numerical Analysis, Theory of Approximations and Their Applications” (NATATA) is in the field of Applied Mathematics and more specifically, as the name of the research group suggests, in the field of Numerical Analysis.

In general terms, in Numerical Analysis one works on the development of methods and algorithms for finding approximate solutions of complicated problems that cannot be solved exactly with the help of standard algebraic and analytic methods. An important aspect of Numerical Analysis is the subfield of Approximation Theory which is concerned with finding methods to approximate complex functions or objects with simpler functions or objects that are easier to work with and at the same time keeping the approximation as good as possible. In this process the main challenge is to find the balance between accuracy and complexity of the approximation. Numerical Analysis and Approximation Theory are used in many fields, for example in physics, engineering, medicine and biology, climate science, astronomy and space science, finance and economics, quality control and optimization. These applications emphasize the importance of Numerical Analysis and Approximation Theory because the research in the subject is not just developing new mathematics but also trying to solve practical problems in different fields important in the development of the modern world.

Based on the arguments above, the main goals of targeted by the scientific group NATATA are:

proving original theoretical results, developing new numerical methods, algorithms, mathematical models for a variety of problems coming from applications, analyzing classical problems in the field of Approximation Theory and Numerical Analysis.

The research work of the scientific group can be grouped in 5 (five) work directions (WD):

- WD 1: Design, analysis, and implementation of numerical methods for nonlinear hyperbolic systems of PDEs**
- WD 2: Classical and new inequalities in Approximation Theory**
- WD 3: Approximation by linear operators in abstract function spaces**
- WD 4: Max-min and min-max polarizations of codes and designs in polynomial metric spaces**
- WD 5: Applications to Biology and Biomedicine.**



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### 3.1.5 Computational Heterogeneous Catalysis, Prof. Hristiyan Aleksandrov Ph.D., lead researcher

9:00-13:00 - **Auditorium 45, Rectorat**

10:30-11:00 Coffee break

Prof. Hristiyan Aleksandrov  
**Brief introduction of the project and  
the group**

Prof. Hristiyan Aleksandrov  
**Conversion of CeO<sub>2</sub> particles into 2D  
clusters**

Assoc. Prof. Iskra Koleva  
**Characterization of Metal Cations (Pd, Pt,  
Ni, Cr, Cu) as [M-OH]+1/1Al or M+2/2Al in  
Zeolites and their catalytic applications**

Boyana Sabcheva  
**Surface-subsurface preference of S  
species on transition metal nanoparticles**

Anastasia Yazova  
**DFT modeling of C-C bond formation/  
breaking on fcc transition metals**

Dr. Masoomeh Keyhanian  
**DFT-Based Computational Design of Ti-  
Doped Ceria Nanoparticles: From Mono- to  
Multi-Doping and Their Reducibility**

Head Assist. Prof. Kristina Simeonova, Teodor  
Ivanov, Assoc. Prof. Miroslava Nedyalkova,  
Prof. Petko Petkov  
**Correlation of the Electronic Properties  
of 2D Conjugated MOFs with Their Linker  
Aromaticity**

### 3.1.5 Computational Heterogeneous Catalysis, Prof. Hristiyan Aleksandrov Ph.D., lead researcher

With the rapid development of computer technologies in recent years, research in the field of developing new catalytic materials has changed significantly, with methods of quantum and computational chemistry playing an increasingly important role in this process. These methods allow us to study materials and the reactions occurring on their surfaces at the atomic level, as well as to understand the behavior of electrons in a given material, the essential intermolecular interactions, etc.

Quantum chemical studies conducted within the project provided useful data necessary to clarify various experimental investigations. Importantly, in many cases, these data cannot be obtained in any other way except through computational experiments. Thus, they contributed to elucidating the detailed structure of various catalysts used in processes important for industry and environmental protection, such as: treatment of automotive exhaust gases; capture and storage of harmful and greenhouse gases; hydrogen production from water; conversion of ethylene into butene or acetaldehyde; selective catalytic reduction of nitrogen oxides; methane oxidation; and utilization of CO<sub>2</sub> through its conversion into methane, etc.

In many of our studies, new catalytic systems were proposed in which the amount of expensive noble metals, such as platinum, rhodium, ruthenium, palladium, gold, iridium, etc., is significantly reduced to clusters of a few atoms and even to isolated cations. Such catalysts with ultra-low noble metal content combine high efficiency, economic viability, and environmental sustainability, making them a key element in the chemical industry.

Using experience gained from modeling porous materials, the group expanded its research to porous layered coordination polymers (2D-MOFs), focusing not only on their structure and sorption properties, but also on their electronic and magnetic characteristics related to their potential applications in electrocatalysis and optoelectronics. fundamental science and practical applications and contribute to the development of new renewable energy sources, more efficient electronic devices, and sustainable technologies.



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### 3.2.2 ZeoNeo, Prof. Valentin Valtchev, lead researcher

9:00-13:00 - **Auditorium 45, Rectorat**

10:30-11:00 Coffee break

Prof. Valentin Valtchev  
**Zeolitic materials for new applications**

Assoc. Prof. Rusi Rusev  
**Adsorption studies of dyes and  
pharmaceuticals onto porous materials**

### 3.2.2 ZeoNeo, Prof. Valentin Valtchev, lead researcher

The ZeoNeo research group develops new materials that help address important environmental and energy-related challenges. Its main focus is on zeolites, a special class of materials with a microscopic porous structure that enables them to “capture” and retain various substances. Thanks to this property, they can be used for water and air purification, for capturing harmful gases such as carbon dioxide, and for accelerating chemical reactions that are important for industry.

The group’s research is aimed at creating more efficient and sustainable materials, with a focus on understanding how their composition and structure influence their behavior. This makes it possible to develop solutions that perform better under real-world conditions, for example in removing pollutants from water or separating gas mixtures.

At the same time, new and more environmentally friendly methods are being developed for producing these materials, requiring less energy and fewer resources. For its research, the team uses modern scientific instrumentation that allows detailed study of the materials and their behavior.

Within the SUMMIT project, a modern laboratory has been established at Sofia University, creating excellent conditions both for scientific research and for the training of young scientists and students.

Through its work, the “ZeoNeo” research group contributes to the development of new technologies with real practical applications, ranging from a cleaner environment to more efficient energy use, combining scientific research with a strong practical orientation.



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### 3.1.13 Climate, Weather and Natural Risks (CW&NR),

Assoc. Prof. Dr. Guergana Guerova, lead researcher

14:00-18:00 - Auditorium 45, Rectorat

16:00-16:30 Coffee break



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Guergana Guerova

**WG1.1 Severe weather forecasting and nowcasting**

Reneta Dimitrova

**WG1.2 Air-quality monitoring and modelling**

Elisaveta Peneva

**WG1.3 Climate feedbacks in the Balkan - Black Sea region**

Biliana Borisova

**WG2.1 Climate hazards and risks**

Kliment Najdenov

**WG2.2 Natural hazards and risks**

Stelian Dimitrov

**WG2.3 Geospatial modeling and mapping approaches and methods**

Evgenia Sarafova

**Urban heat islands in Bulgaria during the heatwave of July 2024**

Metodi Ivanov

**Opportunities for the Development of Disaster Risk Management Capacity in Bulgaria in the Context of Climate Change**

Kalina Radeva

**Observed Change in Precipitation and Extreme Precipitation Months in the High Mountain Regions of Bulgaria**

Kaloian Tsvetkov

**More than Meets the Eye: Older Population and Climate Change Nexus in Serbia and Bulgaria.**

Dimitar Zhelev

**Carbon Footprint Labelling and Consumer Food Choices: Opportunities and Barriers for Climate-Smart Diets in Bulgaria.**

Ianko Gerdjikov

**Late Alpine multistage exhumation of the northwestern Rhodope Metamorphic Complex (northern Rila Mountains, Bulgaria)**

Ianko Gerdjikov

**Variscan basement tectonics and Alpine shear zones in the external Balkanides: Structural data from the Vezhen Massif, Central Stara Planina Mts., Bulgaria.**

Ianko Gerdjikov

**Enigmatic granite-gneiss domes within the Balkan fold-and-thrust belt, Bulgaria: tracers of Gondwana-Baltica proximity and large-scale terrane displacement during the waning stages of the Cadomian orogeny?**

Tania Stoylkova

**Heavy metals contents in Dragovishtitsa River bottom sediments, Kyustendil region, Bulgaria.**

Tsveta Stanimirova

**Comparative Multi-Stage TG-DSC Study of K<sup>+</sup>, Na<sup>+</sup>, Ca<sup>2+</sup> and Mg<sup>2+</sup>-Exchanged Clinoptilolite Forms.**

Borislav Grigorov

**Application of vegetation indices as a step towards the relevance of the condition of beech forest habitats: a case study from Boatin Reserve, Bulgarian Academy of Sciences.**

Lidia Semerdzhieva

**Comprehensive geospatial mapping of urban and peri-urban morphology to support ecosystem- and evidence-based planning.**

### 3.1.13 Climate, Weather and Natural Risks (CW&NR),

**Assoc. Prof. Dr. Guergana Guerova**, lead researcher

The Research Group 'Climate, Weather, Natural Hazards and Risks' (CW&NR) brings together 36 researchers, including early-career scientists and established experts. As of March 2026, the team has published 74 scientific papers in prestigious international journals, demonstrating a significant contribution to the advancement of climate, atmospheric, and environmental sciences. The group's core mission is to improve understanding of climate processes and natural hazards, while also developing practical solutions for risk reduction. To achieve this, state-of-the-art technologies are employed, including satellite observations, numerical modeling, geographic information systems, and artificial intelligence methods. In the field of forecasting hazardous weather events, models and tools for short-term prediction have been developed. These cover phenomena such as thunderstorms, hail, fog, strong winds, floods, and droughts. Innovative solutions have been created, including a fog index and visibility assessment models, which support early warning systems and public safety. In air quality research, a modern multi-model system has been implemented for Sofia, combining regional and high-resolution local models. This system enables more accurate tracking of pollution, particularly from transport, and supports the evaluation of measures such as low-emission zones. Studies reveal a clear link between air pollution, temperature extremes, and human

health. Within the domain of climate processes, long-term datasets for the Balkans and the Black Sea have been analyzed, showing shifts in seasonal patterns and changes in climate regimes. Projections of climate development through the end of the 21st century have also been produced, including changes in cyclonic activity and atmospheric circulation. Research on climate risks examines the impacts of climate change on agriculture, water resources, and ecosystems. Processes such as drought, erosion, and changes in snow cover have been analyzed, along with the effects of the urban heat island. In the field of natural hazards, the team investigates landslides, floods, and other dangerous processes, including specific events in Bulgaria, while developing methods for improved understanding and risk mapping. A particularly important direction is the development of geospatial technologies, including digital models of the urban environment, the use of drones, and the analysis of building solar potential. These innovations support sustainable urban planning and climate adaptation. Overall, the group's work contributes to better preparedness for natural hazards, a cleaner environment, and sustainable development in Bulgaria and the region."



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22 April 2025



## Contemporary Societal Transformations: Digitalization, Social Support and Solidarity, Democratic Participation and Ecological Justice

10:30-12:20 - **Auditorium 63, Rectorat**

10:30-11:00 Coffee break

assoc. prof. Vihra Naydenova, PhD  
**Digitalization and Social Support in Organizational Context.**

assoc. prof. Anna Beshkova, PhD  
**The language of division and the language of solidarity.**

assoc. prof. Stoycho Stoychev, PhD  
**Impact of Electoral Reforms on Democratic Participation in Bulgaria and the EU (2021 – 2024)**

assoc. prof. Ognyan Kasabov, PhD  
**Justice in the context of an ecological crisis**

22 April 2025

### 3.2.5 NUDGE: Behaviour models, attitudes and Policy implementation for sustainable development,

**Prof. Dr. Ivo Vlaev**, lead researcher

14:00-18:00 - **Auditorium 63, Rectorat**

16:00-16:30 Coffee break



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prof. Sonia Karabelova, DSc,  
prof. Snezhana Ilieva, DSc,  
assoc. prof. Kaloyan Haralampiev, PhD  
**Formation of ecological identity in the  
context of new realities: digitalization and  
green economy**

assoc. prof. Boris Popivanov, PhD,  
ch. asst. prof. Dimitar Ganey, PhD  
**Nudges and Pro-Environmental Behavior:  
Barriers and Opportunities for Behavioral  
Interventions in Bulgaria**

ch. asst. prof. Georgi Kirilov, PhD  
**Eye-tracking as an objective indicator  
in personality assessment: integrating  
MMPI-2 and projective methods**

Bilyana Bazovska, PhD  
**From Downshifting to Relocation:  
Understanding Lifestyle Change as a  
Socio-Psychological Process**

prof. Tatyana Tomova, DSc,  
assoc. prof. Elena Kalfova, PhD,  
assoc. prof. Simeon Petrov, PhD  
**The gaps in the design and implementation  
of environmental policies - the role of  
university behavioural science**

Dr. Velina Hristova  
**Effect of visual priming on pro-  
environmental decision-making**

assoc. prof. Svetlina Koleva, PhD  
**Visible and Invisible Threats – Aspects of  
Eco-Anxiety**

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### 3.2.5 NUDGE: Behaviour models, attitudes and Policy implementation for sustainable development, Prof. Dr. Ivo Vlaev, lead researcher



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The NUDGE Research Group at Sofia University “St. Kliment Ohridski” conducts interdisciplinary research in the field of behavioural sciences with the aim of improving the effectiveness of public policies and governance practices. The group’s approach is grounded in the understanding that sustainable societal change requires not only regulatory solutions but also a deep understanding of how people actually behave when making decisions in everyday contexts. In this regard, the team integrates insights from psychology, economics, sociology, political science and public administration to design and implement behavioural interventions (“nudges”) that encourage better choices in a non-intrusive and cost-effective manner, while preserving individual freedom of choice. A key contribution of the group is the development of an innovative methodology for the design, testing and evaluation of behavioural interventions, applicable across a wide range of policy domains.

The research activities are structured around three key areas of high societal relevance. In the field of financial behaviour and tax compliance, laboratory, online and field experiments demonstrate that carefully framed communication messages—based on social norms, moral principles and perceptions of fairness—can significantly increase voluntary tax compliance and enhance the effectiveness of public institutions. In the area of environmental policy, nationally representative studies identify substantial gaps between declared pro-environmental attitudes and actual behaviour. Based on these findings, the group has developed an integrative model for policy

decision-making that incorporates behavioural insights. New approaches to public policy design are proposed, emphasising the central role of scientific evidence in promoting sustainable practices. In the domain of mental health, research highlights the importance of dominant personality traits, value orientations and key social environment factors in shaping sustainable behaviour, while also identifying effective strategies for addressing eco-anxiety and climate-related stress.

The results of the project significantly exceed the initially planned objectives and include over 37 scientific publications in international outlets, active participation in global research networks, and the establishment of partnerships with public institutions supporting the uptake of behavioural approaches in public governance. The practical applicability of the developed tools is reinforced through collaboration with the National Revenue Agency, Sofia Municipality and the National Association of the Municipalities in the Republic of Bulgaria, which have piloted behavioural interventions to improve governance processes.

More broadly, the NUDGE Research Group contributes to the advancement of evidence-based policymaking that is more effective, accessible and better aligned with actual human behaviour. By reducing administrative burden, increasing trust and promoting sustainable choices, the group’s work supports the modernisation of public governance, enhances institutional performance, improves quality of life, and contributes to building a more sustainable and inclusive society.

