



СИБИРСКИЙ
ФЕДЕРАЛЬНЫЙ
УНИВЕРСИТЕТ | SIBERIAN
FEDERAL
UNIVERSITY

Portfolio of scientific supervisors of the participants of the postgraduate track of the International Olympiad of the Global Universities Association

University	Siberian Federal University
Level of English proficiency	B2/C1
Educational program and field of the educational program for which the applicant will be accepted	1.3.6 Optics 2.2.7 Photonics
List of research projects of the potential supervisor (participation/leadership)	<ol style="list-style-type: none"> 1. The Ministry of Science and Higher Education, project “Development of frontier X-ray and optical methods for studying matter and novel materials for applications in photonics, medicine and sensing.” 2023-2025. PI. 2. The Ministry of Science and Higher Education, project “Development of fundamental principles of advanced optical and magnetic materials and synchrotron X-ray spectral methods for studying matter.” 2020-2022. PI. 3. RSF, project 18-13-00363-P “Computational modeling of hybrid 2D nanomaterials for developing new elements for visible and near-infrared plasmonics nonlinear optics elements.” 2021-2022. PI. 4. RFBR, project “Development of synchrotron pump-probe methods for studying the dynamics of phase transitions in liquids.” 2020-2023. Co-PI. 5. RSF project 21-12-00193 “Coherent X-ray spectroscopy of ultrafast photoinduced processes.” 2021-2023. Co-PI.
List of the topics offered for the prospective scientific research	<p>Development of new theoretical methods for X-ray spectroscopy of complex quantum systems with ultra-high time and energy resolution, including synchrotron pump-probe methods for studying the dynamics of phase transitions of molecular and condensed matter.</p> <p>Subwavelength localisation of light in plasmonic and dielectric nanostructures for development of prospective light concentrators and sensors.</p> <p>Atomically precise metal clusters and their composites with plasmonic nanostructures for CO₂ conversion and storage of the products in clathrate hydrates.</p>
	Physical sciences and technology
	<p>Supervisor’s research interests:</p> <p>Resonant X-ray spectroscopy, quantum chemistry, plasmonics, photonics, mathematical modeling (including machine learning).</p>



Research supervisor:
Sergey P. Polyutov,
PhD (Royal Institute of
Technology (KTH), Sweden)

Research highlights:

PhD student gets a research position at the International Research Center of Spectroscopy and Quantum Chemistry (<http://inspeq.sfu-kras.ru>) and can get additional bonuses for publications and other achievements.

The program is financed by grants from the Russian Science Foundation, the Russian Foundation for Basic Research, and the Ministry of Science and Higher Education.

Scientific work is carried out in close cooperation with international research centers worldwide (Sweden, China, India, France, Germany).

Joint PhD double degree programs with leading world universities. Short-term and long-term internships in international scientific centers.

Young research team, international spirit.

During study and research work, housing is provided on campus (1-2 room apartment with payment of about \$30-100 per month), as well as standard social security package.

Requirements of a potential supervisor:

Basic specialization in the field of nonlinear optics, X-ray spectroscopy, nanoplasmonics, quantum chemistry (at least in one of these scientific fields).

Programming skills (C++, Fortran, Matlab etc).

Supervisor's main publications:

43 articles in Q1/Q2 journals indexed by Web of Science and/or Scopus over the past 5 years, including publications in such journals as Reviews of Modern Physics, Physics Reports, PRL, APL, JPCL, Nanoscale etc.

Key publications:

1. F. Gel'mukhanov, M. Odelius, S. Polyutov, A. Föhlisch, V. Kimberg, Dynamics of resonant X-ray and Auger scattering, Reviews of Modern Physics, v.93, p. 035001 (2021). <https://doi.org/10.1103/RevModPhys.93.035001>
2. M. Schroter, S. D. Ivanov, J. Schulze, S. P. Polyutov, Y. Yan, T. Pullerits, O.Kuhn, Exciton-Vibrational Coupling in the Dynamics and Spectroscopy of Frenkel Excitons in Molecular Aggregates, Physics Reports, v.567, p.1-78 (2015), <https://doi.org/10.1016/j.physrep.2014.12.001>.
3. L.K. Sørensen, D.E. Khrennikov, V.S. Gerasimov, A.E. Ershov, M.A. Vysotin, S. Monti, V.I. Zakomirnyi, S.P. Polyutov, H. Ågren, S.V. Karpov, Thermal degradation of optical resonances in plasmonic nanoparticles. Nanoscale, v.14, p. 433-447 (2022). <https://doi.org/10.1039/D1NR06444D>.
4. Ceolin, Denis, Rueff, Jean-Pascal, Zimin, Andrey, Morin, Paul, Kimberg, Victor, Polyutov, Sergey, Agren, Hans, Gel'mukhanov, Faris, Far-Zone Resonant Energy Transfer

in X-Ray Photoemission as a Structure Determination Tool, *Journal of Physical Chemistry Letters* (2017). <https://doi.org/10.1021/acs.jpcllett.7b00835>.

5. A.S. Fedorov, M.A. Visotin, E.V. Eremkin, P.O. Krasnov, H. Agren and S.P. Polyutov, Charge-transfer plasmons of complex nanoparticle arrays connected by conductive molecular bridges. *Physical Chemistry Chemical Physics*, 24, 19531-19540(2022). <https://doi.org/10.1039/D2CP01811J>.
6. M.S. Molokeyev, A.S. Kostyukov, A.E. Ershov, D.N. Maksimov, V.S. Gerasimov, and S.P. Polyutov. Infrared bound states in the continuum: random forest method. *Optics Letters* (2023). <https://doi.org/10.1364/OL.494629>
7. L.K. Sørensen, D.E. Khrennikov, V.S. Gerasimov, A.E. Ershov, S.P. Polyutov, S.V. Karpov, H. Ågren, The nature of the anomalous size dependence of resonance red shifts in ultrafine plasmonic nanoparticles. *The Journal of Physical Chemistry C*. (2022). <https://doi.org/10.1021/acs.jpcc.2c03738>.
8. Dmitrii N. Maksimov, Valeriy S. Gerasimov, Silvia Romano, and Sergey P. Polyutov, Refractive index sensing with optical bound states in the continuum. *Optics Express*. Vol. 28, Issue 26, pp. 38907-38916 (2020). <https://doi.org/10.1364/OE.411749>.
9. Nina Ignatova, Vinícius V Cruz, Rafael C Couto, Emelie Ertan, Andrey Zimin, Sergey Polyutov, Hans Agren, Victor Kimberg, Michael Odelius, Faris Gel 'mukhanov, Gradual collapse of nuclear wave functions regulated by frequency tuned X-ray scattering, *Scientific Reports*, v.7, p.43891 (2017). <https://doi.org/10.1038/srep43891>.
10. Zakomirnyi, Vadim I., Rasskazov, Ilia L., Gerasimov, Valeriy S., Ershov, Alexander E., Polyutov, Sergey P, Karpov, Sergei V, Refractory titanium nitride two-dimensional structures with extremely narrow surface lattice resonances at telecommunication wavelengths, *Applied Physics Letters*, 111, 12 (2017) (JIF=3.41, Q1). <https://doi.org/10.1063/1.5000726>.
11. N. Venugopal, V. S. Gerasimov, A.E. Ershov, S.V. Karpov, S.P. Polyutov, Titanium Nitride as Light Trapping Plasmonic Material in Silicon Solar cell, *Optical materials*, V. 72, Pp 397–402 (2017) <https://doi.org/10.1016/j.optmat.2017.06.035>.