



Univerza v Ljubljani



HR EXCELLENCE IN RESEARCH

## UNIVERSITY OF LJUBLJANA (UNIVERZA V LJUBLJANI - UL)

is a public autonomous educational, research and artistic HE institution with a very rich tradition. It was established in 1919 and it encompasses 23 faculties and 3 art academies.

**Faculty of Chemistry and Chemical Technology** is committed to basic, applied and development research, trying to achieve excellence and highest quality standards in the areas of chemistry, biochemistry, chemical engineering, fire safety and occupational safety. Physical Chemistry Laboratory is part of Faculty of Chemistry and Chemical Technology. Physical Chemistry Laboratory is the only group in Slovenia doing research and providing education in physical chemistry.

**UL ranks among the top 500** universities according to the ARWU Shanghai ranking and among the top 3% Universities in the world according to the Times ranking. According to the Spanish Webometrics UL takes 29<sup>th</sup> place among European universities, and 3<sup>rd</sup> place among Central and Eastern European universities.

**By number of students**, UL ranks among the largest HEI with 35.813 students enrolled in the first cycle study programmes, 10.998 to the second cycle study programmes and 2.318 to the third cycle in the ay 2012/2013.

**Research activity** UL is very active in national and international R&D and educational programmes. In 2013 UL cooperated in 157 national research programmes, 176 basic and 72 applied research projects, 26 post-doc projects, 39 targeted research projects (CRP) and 7 technological platforms with over 3000 certified researchers. In the period 2007-2013 UL cooperated in **745 EU projects**, including **163 FP7 projects**, which rank UL on the first place among

Name of the Organization: **Univerza v Ljubljani (UL)**

Faculty: Faculty of Chemistry and Chemical Technology

Contact: **prof. dr. Tomaz Urbič**, [tomaz.urbic@fkkt.uni-lj.si](mailto:tomaz.urbic@fkkt.uni-lj.si)

University of Ljubljana, Faculty of Chemistry is looking for partners to apply together for a MSCA ETN or RISE project.

## TOPICS INTERESTED

- Computer simulation,
- water,
- solvation,
- phase diagrams,
- integral equation theory,
- density functional theory,
- liquids,
- electrolytes,
- polyelectrolytes,
- colloids,
- polymers,
- alcohols.

## CALLS INTERESTED

- ETN - European Training Networks (H2020-MSCA-ITN-2015)
- RISE - Research Innovation Staff Exchange, (H2020-MSCA-RISE-2015)

## SKILLS & EXPERTISE OFFERED

- Partner/Beneficiary
- Training researchers
- Supervising researchers

## DISCIPLINARY RESEARCH EXPERTISE

TU has been so far engaged in studying several different aspects of Physics and Chemistry of liquids. TU developed codes for the Monte Carlo simulations of model water and aqueous solutions in various ensembles, the thermodynamic perturbation theory, the density functional theory and the orientational-averaged and angle-dependent integral equation theories. The theories are based on Wertheim's multi-density approach developed for fluids with directional forces.

Physical Chemistry Laboratory is running research connected with educational process, which includes number of subjects from quantum chemistry and statistical thermodynamics on one side to colloid and surface chemistry on the other. This broad spectrum is reflected in the research. The individual researchers are collaborating with colleagues around the globe, seeking the »critical size« needed for quality research work.

### Research covered topics include

Thermodynamics, calorimetry, spectroscopy, transport properties, electrolyte solutions, polyelectrolytes, polyampholites, surfactants, proteins, nucleic acids, microemulsions, SAXS, water, solvation, hydrophobic interaction, statistical thermodynamics, computer simulations, adsorption, integral equations.

## INNOVATION

Aqueous solutions of electrolytes and (bio)polyelectrolytes play important role in science and technology. Ions, simple and complex, take place in vital processes in our organism. The role of water in these processes, though crucial, is not fully understood yet. There are books written about the 'hydrophobic interaction', but the opinions about its mechanism are not unique. Investigation of protein stability in presence of macromolecules and added salts, studies of ligand binding to DNA, are important for pharmaceutical industry and in bioengineering. On the other hand, understanding the properties of polyelectrolytes, surfactants and colloids and their interaction with surfaces is important for ecology and industry. Our studies are also important for biomedical sciences.

the RO in the EU-13 countries.

## PUBLICATIONS

**URBIC, Tomaz**, VLACHY, Vojko, KALYUZHNYI, Yu. V., SOUTHALL, N. T., DILL, K. A. A two dimensional model of water : theory and computer simulations. *The Journal of chemical physics*, February 2000, vol. 112, str. 2843-2848

**URBIC, Tomaz**, VLACHY, Vojko, KALYUZHNYI, Yu. V., DILL, K. A. Orientation-dependent integral equation theory for a two-dimensional model of water. *The Journal of chemical physics*, 2003, vol. 118, str. 5516-5525

**URBIC, Tomaz**, DILL, Ken A. A statistical mechanical theory for a two-dimensional model of water. *The Journal of chemical physics*, 2010, vol. 132, art. no. 224507

**URBIC, Tomaz**. Liquid-liquid phase transition in a two-dimensional system with anomalous liquid properties. Physical review. E, Statistical, nonlinear, and soft matter physics, 2013, vol. 88, art. no. 062303.

**HUŠ, Matej**, **URBIC, Tomaz**. Strength of hydrogen bonds of water depends on local environment. *The Journal of chemical physics*, 2012, vol. 136, art. no. 144305

## FUNDING

Member of the project "**Solvation and ion specific effects in biological systems**", supported by Slovenian Research Agency. P.I. V. Vlachy.; Grant No.: J1—4148 Period: 1.7.2011—30.6.2014.

Member of the project "**Properties of ionic solutions and disperse systems**", supported by Slovenian Research Agency. P.I. V. Vlachy.; Grant No.: J1—6653 Period: 1.7.2004—30.6.2007.

Partner in project "**Modelling Aqueous Solvation in Biology**", supported by National Institutes of Health (NIH), USA. P.I. K.A. Dill and V. Vlachy.; Grant No. GM063592 2002 - 2014.