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Conference “Advances and Applications in Plasma Physics” guided by the world’s famous publisher Nature Research at Peter the Great St.Petersburg Polytechnic University

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THE STELLAR POTENTIAL OF THERMONUCLEAR FUSION

Peter the Great St. Petersburg Polytechnic University is utilising a multidisciplinary approach to harness the power of a star in pursuit of green energy

SCIENTISTS AND industry delegates gathered at Peter the Great St. Petersburg Polytechnic University (SPbPU) for the Advances and Applications in Plasma Physics Conference to share research and ideas from a variety of fields.

At the event, which took place from 18-19 September, were scientists specialising in nuclear fusion, low-temperature plasmas, astrophysical plasmas and laser-plasma interactions. Vladimir Rozhansky, head of the laboratory of controlled thermonuclear fusion at SPbPU, says that the conference presentations afforded delegates a broad perspective on plasma physics and the challenges faced when turning theoretical propositions into real-world applications.

More than half of the presentations were on nuclear fusion, which is of particular interest to Professor Rozhansky, whose research into plasma physics and controlled thermonuclear fusion led him to join the ITER Science and Technology Advisory Committee in 2018. ITER brings together scientists from 35 countries to collaborate on the design and development of the world's largest tokamak – a magnetic fusion device for producing controlled fusion reactions in hot plasma. If the tokamak is successful, the principal of using thermonuclear fusion to generate clean energy will be feasible.

'Every step is connected with modern technologies'

Vladimir Rozhansky

Russia has been at the forefront of this research, with Igor Tamm and Andrei Sakharov first drafting the theoretical foundations for tokamak design and SPbPU playing an important role in the ITER project. The university's SOLPS-ITER numerical code, developed in 2017 for modelling the parameters of near-wall plasma, is now used as standard on ITER.

If the theory behind ITER's tokamak seems abstract to the uninitiated, the numbers alone indicate the project's scale. ITER is, in effect, creating the power of a star on Earth, housing it within the tokamak. For a fusion reaction to happen inside the tokamak, its core temperature must reach 150 million°C – a temperature 10 times hotter than the Sun. Professor Rozhansky forecasts that, by the end of 2025, ITER will create a positive output whereby the energy released during a controlled thermonuclear reaction is equal to or greater than the cost of heating the plasma in the reactor.

One avenue of enquiry involves modelling edge plasma within the ITER tokamak to see whether injecting impurities can protect it from the immense energy flux from its core. Such research needs considerable scientific talent and government funding, says Professor Rozhansky. "For this task we need many many young people who are prepared to do this; not only plasma physicists but engineers of different kinds – software engineers in particular – because every step is connected with modern technologies."

Students work closely on ITER-related research, says Professor Rozhansky, but he warns that long-term government funding is essential to retain the best and brightest talent and "bring fusion into life".

120 | ПОЛИТЕХ

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