

Prof Marija Vranic wins the 2022 PRACE Ada Lovelace Award for HPC



Dr Marija Vranic

PRACE is delighted to announce that Dr Marija Vranic, Invited Professor at the Instituto Superior Técnico of the University of Lisbon is the winner of the 2022 PRACE Ada Lovelace Award for HPC for her outstanding impact on HPC in Europe. Dr Vranic has not only pioneered techniques for representing quantum effects in extreme plasmas, she is also actively involved in improving the visibility of women in physics and HPC — for instance, by reducing the gender imbalance of invited speakers at scientific conferences. The Award will be presented to her at the [EuroHPC Summit Week 2022 / PRACEdays22](#), where she will give a keynote speech entitled “Extreme plasma on a supercomputer” and participate in the closing panel discussion on “Emerging applications, model and implementation” on Thursday, 24 March 2022.

The focus of [Dr Vranic's research](#) is the interaction of light with plasmas in extreme conditions — a research field that has significantly gained in relevance recently, especially since the [Extreme Light Infrastructure \(ELI\)](#) will soon be coming online in Europe. The ELI facilities will be able to generate laser beams that are around 10 000 times more intense than today's lasers, and consequently create plasmas immersed in intense electromagnetic background. “Extreme plasmas naturally exist near stars and pulsars. With the new facilities, we will have the opportunity to recreate and study such plasmas in extreme conditions experimentally for the first time,” explains Vranic.

However, interactions of such high-energy lasers with particles like electrons or positrons will give rise to quantum processes coupled with plasma dynamics that are unseen in today's lasers. Dr Vranic has tackled challenges related to the efficient modelling of these quantum phenomena within highly parallelized numerical simulations of plasmas on HPC systems — and she has done this very successfully.

Already during her PhD at the [Instituto Superior Técnico \(IST\)](#) of the University of Lisbon, Marija Vranic pioneered the implementation of a so-called [radiation cooling model](#) in light-particle interaction algorithms. Radiation cooling accounts for the energy loss that particles experience when interacting with the novel extreme-intensity lasers beams. Also, Vranic developed a [particle merging algorithm](#) that allows scientists to simulate the large number of quantum particle pairs that arise in extreme plasmas: pairs of electrons and positrons will be generated in exponentially growing cascades that cannot be handled even when using highly parallelized HPC systems. Vranic's merging algorithm allows to dynamically downsize the system without losing the relevant physics. Her contributions are crucial for modelling extreme plasmas and have since been implemented in a number of codes by the plasma physics community.

Later, as a junior researcher at ELI Beamlines in Prague, Vranic studied the possibilities for future experiments with the facility's high-intensity lasers and made an important discovery: Using specific laser settings, positron beams, which are inherently difficult to generate and to handle, can be [created and accelerated in just one single laser-electron beam collision](#) — without the need of having separate creation and acceleration stages. Since 2020, Vranic is an Invited Professor and Independent Junior Researcher at IST, where she is currently focusing on a new scheme for creating and accelerating positrons.

As a result of her outstanding work, the physicist has already won a number of scientific awards and grants, including a Junior Scientist Grant of the Portuguese Foundation for Science and Technology, where she incidentally ranked first nation-wide, the prestigious IBM Scientific Prize 2018 awarded by the President of Portugal, or the John Dawson PhD thesis prize in 2017, which is awarded for the best PhD thesis worldwide in the area of plasma-based accelerators.

"I am really happy that my activities have now been honoured with the PRACE Ada Lovelace Award," Marija Vranic states. "With this award, PRACE raises awareness for women in HPC and science, which is extremely important. I am personally painfully aware of the gender imbalance in HPC and physics — in plasma physics especially," she adds. "I grew up and studied in Serbia, where women are more represented in science. So, for me, it was a shock to learn that there are much fewer female physicists in most other European countries."

Indeed, Vranic regards it as her responsibility to help changing this and is actively promoting the careers of women. She has, for instance, been part of the work of the [Diversity and Gender Balance group](#) at IST, and recently, she mentored a group of graduate students at IST to form a [Women in Physics group](#) with the goal to give female scientists a place to meet, discuss and ask advice. In addition, as a committee member of a large European conference on plasma physics, Marija Vranic has motivated her colleagues to purposely nominate women as invited speakers. "I believe it is rare that discrimination is done on purpose. Gender imbalance happens when people don't pay attention," Vranic says. "We have to educate decision makers about their unintentional bias and remind them to actively consider women in underrepresented fields."

She regards the visibility of women in physics to be extremely important and welcomes her own capacity as a role model. "It is essential that we gain more visibility as role models for young women in STEM. The more visible we are as female scientists, the less shy and guarded will future generations be."

"Dr Marija Vranic studies interaction of laser beams with particles while accounting for quantum effects, which in such conditions can have important impact. Her contributions, achieved partly through PRACE-supported projects, are crucial to advance our understanding of plasmas in extreme conditions," said Dr Laura Grigori, Chair of the PRACE Scientific Steering Committee.

About the PRACE Ada Lovelace Award

Launched in 2016, the [PRACE Ada Lovelace Award](#) is annually awarded to a female scientist who makes an outstanding contribution to and impact on HPC in Europe and the world, and who serves as a role model for women who are at the start of their scientific careers. The award is named after the Countess of Lovelace, a British mathematician who lived in the 19th century and among else worked with Charles Babbage on the Machine they called the Analytical Engine — one of the first precursors of computers. Many historians regard Ada Lovelace's contribution to this mechanical calculator as the very first algorithm — and herself as the first person to be rightly called a programmer.

About PRACE

The Partnership for Advanced Computing in Europe (PRACE) is an international non-profit association with its seat in Brussels. The PRACE Research Infrastructure provides a persistent world-class High-Performance Computing service for scientists and researchers from academia and industry in Europe. The computer systems and their operations accessible through PRACE are provided by five PRACE members (BSC representing Spain, CINECA representing Italy, ETH Zurich/CSCS representing Switzerland, GCS representing Germany and GENCI representing France). The Implementation Phase of PRACE receives funding from the EU's Horizon 2020 Research and Innovation Programme (2014-2020) under grant agreement 823767. For more information, see www.prace-ri.eu

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