In February, a postdoctoral scientist conducting research into the structure of the proton was awarded the 2010 JSA Postdoctoral Research Fellowship at Jefferson Lab.

Simona Malace, from the University of South Carolina, was named the winner of the fellowship by the Jefferson Lab Users Group Board of Directors, which represents the roughly 1,300 scientists who conduct research at the laboratory.

“I am very happy to receive this prize, and I would like to thank Dr. Wally Melnitchouk, Dr. Rolf Ent and Dr. Steffen Strauch for their support throughout my research,” Malace said.

Malace studies how quarks and gluons come together to build nucleons. To conduct the research, she and her colleagues use JLab’s CEBAF accelerator to smash electrons into proton and deuteron targets.

“Imagine sending a probe, at JLab this is an electron, to get information about the structure of the proton. Depending on the energy of the probe, you will see larger or smaller structure. Sometimes the quarks in a proton bind together to make more massive versions of the proton called resonances. These are the objects (a type of hadron) we want to study. Surprisingly, they behave the same way on average as the much smaller, individual, quarks do. This observation is called quark-hadron duality, and it is quite a mystery.”

Malace, in collaboration with fellow physicists Yonatan Kahn, Melnitchouk and Thia Keppel, is studying the differences in the results when looking at the proton and neutron resonances. The latter are very difficult to study, as there are no free neutrons in nature. However, such work is critical to understanding the mystery of duality as a truly fundamental property of hadron structure.

The fellowship comes with a $10,000 research grant that Malace will use to defray the cost of a workshop to be scheduled this year addressing research into the underlying quark structure of the nucleon. The workshop is tentatively titled “Building knowledge of nucleon structure at large Bjorken x.”

Malace received her bachelor’s and master’s degrees from the University of Bucharest in Romania and her Ph.D. from Hampton University. Now, as a postdoc at the University of South Carolina, she has broadened her research interests to include another aspect of the proton’s properties: How a proton that is bound inside a nucleus is different from a proton that is not.

“We hope to scatter from a proton that is sitting inside a nucleus and then we want to compare it to the response of a free proton. The changes we see are due to the presence of the nuclear medium. The challenge is then to interpret these changes in terms of varied nuclear effects and possibly answer the question whether the proton structure is modified in the nuclear medium,” she said.

In making the award selection, the users board judged applicants on their records of accomplishment in physics, proposed uses of the research grant in a high-impact physics program and the likelihood of further accomplishments in the Jefferson Lab research program.

“We had a slate of outstanding and deserving candidates contributing to the physics mission of Jefferson Lab. In fact, four candidates obtained first place votes, making our evaluation and choice of a winner truly difficult,” said Zein-Eddine Meziani, board chairman and a professor at Temple University.

“The winner has participated in a broad program of research, having performed analyses on two very different experiments. She is an integral member of her collaborations, is leading a new 12 GeV proposal and has a range of publications.”

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