

Professor Ina Sarcevic
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To:

IB Chair

Dr. Robert Wilson, Professor of Physics at Colorado State University

DUNE Collaboration Co-spokespersons

Dr. Mark Thompson, Professor of Physics at University of Cambridge

Dr. Andre Rubbia, Professor of Physics at ETH Zurich

The University of Arizona would like to join DUNE Collaboration. We submit this letter to the IB board, in accordance with & 2.2 of the "Governance of the DUNE Collaboration"

List of persons wishing to join DUNE collaboration

Dr. Ina Sarcevic (Professor of Physics and Astronomy)

Dr. Yu Seon Jeong (Postdoctoral Fellow)

Institutional representative

Professor Ina Sarcevic will serve as the institutional representative for the University of Arizona.

Scientific and technical Interests of the Group

We would like to contribute to DUNE collaboration with the study of physics Beyond the Standard Model with DUNE. Here we give several examples of the projects that we would like to pursue in collaboration with the members of the DUNE Physics Working Group.

We would like to consider models of neutrino mass generation with new Abelian U(1) gauge symmetry, in which neutrinos are light due to a low scale of symmetry breaking. In these types of models, there are in general new interactions of neutrinos with the light bosons. We would like to explore implications of these new interactions on supernova neutrino flux that might be detected with DUNE. The interaction of supernova neutrinos and the cosmic background neutrinos, via exchange of these new light scalars, results in a dramatic change of the supernova differential neutrino flux. Measurement of this effect with DUNE could potentially provide a spectacular direct evidence for the low scale models (new Abelian U(1) gauge symmetry), in which neutrinos are light. In addition, we would like to explore the parameter space in this model that might allow one to distinguish between neutrinos being Majorana or Dirac particles, the type of neutrino mass hierarchy (normal or inverted or quasi-degenerate), and could also possibly determine the absolute values of the neutrino masses. We would like to consider detection of these effects with DUNE.

We would also like to study the case when scalar dark matter with mass in the MeV range is coupled to ordinary neutrinos and another fermion, motivated by scenarios that establish a link between radiatively

generated neutrino masses and the dark matter relic density. In this case, the cosmic supernova neutrinos resonantly interact with the background dark matter particles on their way to us, giving rise to a dip in their redshift-integrated spectra. We would like to consider detection of the light dark matter with DUNE in this scenario.

Finally we are also interested in considering cosmic neutrinos, as well as atmospheric neutrinos, and their beyond the Standard Model interactions that one could potentially detect with DUNE. Our previous work in these areas gives us background to pursue these studies. In addition, we would like to participate in collaboration with other members of the DUNE Physics Working Groups in various DUNE-related projects.

Resources that the group is planning to contribute to DUNE

We plan to devote 0.3 FTE equivalent to DUNE related research activities in the first two years. It is likely that this fraction would increase after that, and we plan to recruit graduate students to work on DUNE related research starting in Fall 2017. The group would like to participate in the Physics Working Group, in particular cosmic/cosmogenic, supernova and atmospheric neutrino working groups. Our experience in these areas will be helpful in pursuing the goals of the groups.

Potential sources of funding

Professor Sarcevic is currently funded by DOE for neutrino and dark matter research. This funding provides support for a postdoctoral fellow Dr. Yu Seon Jeong. With increasing efforts, in particular adding the DUNE related research, Professor Sarcevic is planning to ask for additional funds from DOE.

Thank you for considering our proposal and we hope to be able to join DUNE efforts.

Sincerely,



Dr. Ina Sarcevic
Professor of Physics and Astronomy



Dr. Yu Seon Jeong