

To: Dr. Matthias Neubert; Director: MITP
From: Eve Armstrong, Baha Balantekin, Rebecca Surman, Cristina Volpe;
co-hosts: “Collective Neutrino Oscillations” workshop: MITP
Date: 2023 June 25
Subject: Report on our MITP workshop

Dear Dr. Neubert,

This document constitutes our report regarding the workshop you invited us to host at the MITP: “Collective Neutrino Oscillations: from quantum information science to heavy element nucleosynthesis,” 2023 May 25-27. In planning the workshop, we aimed to bring together key players in the study of collective neutrino oscillations: a field that spans many interrelated areas. Within that context, we each focus on a relatively small area. Further, younger participants – in part because of the pandemic – had not had the opportunity to interact in person. To drive the field forward efficiently, it is important on occasion to switch focus from one’s individual work to that of others, to identify the ways in which we complement each other and together build a broader picture.

The workshop schedule consisted of two main components: 1) unstructured time in the mornings for discussion/work, and 2) one to two hours of talks in the afternoon, followed by additional unstructured time for discussion. Many conferences center on talks, and leave little time for constructive work. We instead set aside the full mornings – when participants are most alert and energized – to cultivate creative ideas. Then we scheduled two to three short talks each afternoon, both as a chance for participants to familiarize each other with their work, and to motivate further discussion.

This design worked well. Those of us in existing collaborations, and who usually interact via video/email, were able to make much more rapid progress in person. As for new collaborations, many participants commented to us that the discussions gave them the chance to see their own work through fresh lenses, and to identify extensions of their work into new directions. Thus, existing collaborations accelerated their progress, and new collaborations were born. We hence believe that this workshop will have a positive impact in the development of the field of collective neutrino oscillations in astrophysical settings.

One “big picture” question, for example, is the ability of theory (particularly small-scale models) to inform the significance of a real neutrino detection from an astrophysical event (i.e. core-collapse supernova or neutron star merger). Participants’ expertise ranged from pure modeling to inference and machine learning procedures for optimizing models with available data. Thus we were able to have in-depth discussions on how to prepare our computational machinery for such an event.

In terms of diversity: the age range spanned first-year postdocs to senior faculty, and half of the participants were women – quite remarkable for a physics meeting.

For the future, one aspect of the workshop to improve upon is the schedule of talks. Some participants were able to attend for just one of the two workshop weeks, thus missing talks they would have liked to attend.

Finally, beyond being intellectually stimulating and satisfying, the workshop was extremely enjoyable – thanks to your staff. Logistics ran smoothly, and we felt welcome, comfortable, secure, and well fed. Thank you all for a wonderful experience. We look forward to seeing you again.

Best wishes,

Eve, Baha, Rebecca, and Cristina