THE 2024 CANPAN/NUGRID TRAINING PROGRAM

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SUMMARY

CaNPAN is excited to announce its Fall 2024 training program for students specializing in experimental nuclear physics or stellar astrophysics. This year, we are partnering with the NuGrid collaboration for their annual meeting at Brookhaven National Laboratory in December. As a highlight of the program, participants will contribute to a hybrid component of the NuGrid/IReNA/BNL Open Day (HTTPS://NUGRID.GITHUB.IO/CONTENT/COLLAB-MEETING-2024.HTML), where they will have the opportunity to present their projects in short talks.

PROGRAM STRUCTURE

Participants will engage with a series of numerical problems using computer codes and Python notebooks from the Networkschool-tina, i-process tools, and canpan-project Git repositories. Weekly online meetings will be held from October 17 to November to introduce students to the fundamentals of stellar and nuclear astrophysics and guide them in the use of these computational tools.

The numerical methods taught have been successfully employed in previous studies, including:

- Reaction rate impact studies for nova nucleosynthesis, directly connected to observed abundances of elements like potassium and calcium in nova ejecta
- p-nuclei production in X-ray bursts and core-collapse supernovae, linked to the observed solar system abundances of p-process isotopes
- Identification of neutron-capture reactions impacting predicted abundances of i-process elements, as observed in CEMP-i and CEMP-s stars

The goal of these studies is to identify neutron-capture reactions having the strongest impact on predicted abundances, for example on the i-process
elements observed in CEMP-i and CEMP-s stars. A list of reactions that have been identified in this way, and their approved experimental studies at U.S. and Canadian nuclear physics laboratories is available at HTTPS://CANPAN.CA/EXPERIMENTS.HTML.

PROPOSED PROJECTS

All projects will be conducted on the University of Victoria's AstroHub TINA and Outreach servers. Students may choose from the following projects or propose their own:

- Sensitivity of p-nuclei production in X-ray bursts or core-collapse supernovae to charged-particle reaction rate variations
- Sensitivity of K and Ca production in novae to charged-particle reaction rate variations

- Constraining rates of neutron captures by unstable isotopes using numerical simulations of i-process nucleosynthesis in stars and astrophysical observations

Students are encouraged to verify previous results and explore reactions impacting other nuclei, such as p isotopes ^{92}Mo and ^{96}Ru in X-ray bursts, or unstable isotopes ^{7}Be and ^{22}Na in novae.

For the i-process project, students will create plots of elemental abundance ratios in CEMP-s and CEMP-i stars, comparing observational data with i-process nucleosynthesis model predictions. They will investigate variations in neutron-capture rates for unstable isotopes and their impact on predicted abundances.

HOW TO PARTICIPATE

Participation is limited to 5 students to ensure a high level of interaction and support. Interested students should send an email to Dr. Pavel Denisenkov (PAVELDEN@UVIC.CA) by October 15 with the following information:

- Name, Institution, and Name and email address of supervisor
- Short statement of past research experience and current research project
- What type of project are you interested in? select one of the above mentioned or propose something different

Sign-up details will be provided October 16, and the program will commence on October 17.

For more information on the computational tools and detailed instructions, please visit:

- Networkschool-tina: HTTPS://GITHUB.COM/NUGRID/NETWORKSCHOOL-TINA/TREE/MAIN
- CaNPAN project: HTTPS://CANPAN.CA/INDEX.HTML

This training program offers a unique opportunity to gain hands-on experience with cutting-edge computational tools in nuclear astrophysics. Participants will contribute to ongoing research efforts and develop skills valuable for future work in the field.