

A Summer Research Experience in Taiwan

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Caleb Eldridge, Joel Watson, and Ethan White attended the PIRE-GEMADARC summer school and collaboration meeting in Taipei, Taiwan and then spent six weeks researching different projects. We will talk about the research experience itself (sight-seeing, food-tasting and miscellaneous adventures) and then present our respective projects:

Interactions between neutrinos inside neutrino dense environments, such as core collapse supernova, cause non-linear effects on neutrino oscillations, which act on a nanosecond scale. These fast flavor conversions affect the relative number of electrons and heavy neutrinos which have effects on the progression of the explosion and processes like the formation of heavy elements. Joel and Caleb will share their research using the COSEv simulation engine to investigate this collective neutrino oscillation. They will show the way in which these fast flavor oscillations produce waves of flavor conversion, and visually show these waves form and propagate, along with a general discussion on the limitations and inner workings of COSEv. They will also discuss the lessons learned and challenges faced doing computational research throughout the research experience.

Theoretical explanations for axion-like particle (ALP) properties are vast, however experimental searches remain difficult. In theory, properties of solar-ALPs can be well studied under the inelastic inverse Primakoff process. The ALP-photon-photon coupling constant, $g_{\text{a}\gamma\gamma}$, is of particular interest due to experimental searches being competitively scarce. Ethan will share his research using the underground XENONnT and surface germanium detector TEXONO dark-matter (DM) search experiments' data to probe the $g_{\text{a}\gamma\gamma}$ - m_a parameter space. In this talk, solar-ALP flux and inelastic inverse Primakoff process cross section are considered for different form factors and the complementing DM-search signal datasets are examined and compared to these theoretical formulations.