

**Hidden Neutrinos:
Symposium in honor of the
90th birthday of Frank
Aignone**

Report of Contributions

Contribution ID: 1

Type: **not specified**

Welcome

Friday, 19 May 2023 09:00 (10 minutes)

Session Classification: Registration

Contribution ID: 2

Type: **not specified**

Dean's Welcome

Friday, 19 May 2023 09:10 (10 minutes)

Presenter: Prof. ROBERTS, Jane (Associate Dean for Natural Sciences, USC)

Session Classification: Registration

Contribution ID: 3

Type: **not specified**

Dark Matter and Dark Stars

Friday, 19 May 2023 09:20 (40 minutes)

I'll begin by reviewing the current status of Direct Detection searches for Dark Matter, an experimental effort begun by Frank Avignone! Then I will turn to the potential discovery of Dark Stars in early data from the James Webb Space Telescope. These would have been the first stars in the Universe, made (almost entirely) of hydrogen and helium, but powered by the heat from Dark Matter annihilation rather than by fusion. The relevant types of dark matter include Weakly Interacting Massive Particles (WIMPs) and Self Interacting Dark Matter (SIDM). Although dark matter constitutes only $\sim 0.1\%$ of the stellar mass, this amount is sufficient to power the star for millions to billions of years. They are very bright diffuse puffy objects and grow to be very massive. In fact, they can grow up to ten million solar masses with up to ten billion solar luminosities. Once the dark matter fuel runs out and the dark star dies, it may collapse to a black hole; thus dark stars may provide seeds for supermassive black holes observed at early times as well as in galaxies today. Of the 700 high redshift objects found by JWST so far, only 10 have spectra and we have access to 5 of those. Of the four JADES objects (JWST Advanced Deep Extragalactic Survey), three are consistent with an interpretation in terms of Dark Stars. Future detailed spectra will be able to differentiate between DS and high redshift galaxies. It is an exciting prospect that the first discovery of WIMPs could be via the discovery of Dark Stars!

Presenter: Prof. FREESE, Katherine (University of Texas, Austin)

Session Classification: Registration

Contribution ID: 4

Type: **not specified**

Neutrinos in Astrophysics

Friday, 19 May 2023 10:00 (40 minutes)

Astrophysics played a critical role in the discovery of neutrino mass and mixing: A 40-year effort to understand the evolution of the Sun led to a model that could not accommodate the observed pattern of neutrino fluxes, thus demanding new physics. The connection between neutrino microphysics and macroscopic properties of supernovae, neutron star mergers, and nucleosynthesis has become a driving theme of the emerging field of multi-messenger astrophysics. Neutrinos control transport in such events and determine their thermodynamic trajectories. Conversely, these events create exotic conditions under which we can probe properties of neutrinos that are beyond the reach of laboratory tests. I will give some examples of the progress that could be made as we become ever more adept at using the universe as our laboratory.

Presenter: HAXTON, Wick (UC Berkeley)**Session Classification:** Registration

Contribution ID: 5

Type: **not specified**

Axion Searches

Friday, 19 May 2023 11:00 (40 minutes)

Presenter: SIKIVIE, Pierre (University of Florida)

Session Classification: Registration

Contribution ID: 6

Type: **not specified**

Axion Dark Matter: ABRACADABRA and Beyond

Friday, 19 May 2023 11:40 (40 minutes)

The particle nature of dark matter remains one of the great open questions in physics. The axion has had a renaissance as a dark matter candidate as theoretical studies have improved our understanding of axion cosmology and advances in quantum sensing and cryogenics have opened new opportunities for detection. In this talk, I will present the current results from ABRACADABRA and our vision for the DMRadio program which aims to definitively search for GUT-scale axions throughout this < 1 micro-eV space. The talk will also discuss the challenges in realizing this vision from an experimentalist's perspective.

Presenter: WINSLOW, Lindley (MIT)

Session Classification: Registration

Contribution ID: 7

Type: **not specified**

Probing the elusive nature of neutrinos

Friday, 19 May 2023 14:00 (40 minutes)

Not quite 90 years ago, Ettore Majorana informed Enrico Fermi “I have found a representation where all Dirac γ matrices are real. In this representation it is possible to have a real spinor that describes a particle identical to its antiparticle.” Such Majorana neutrinos, could potentially provide an explanation for the neutrino’s elusive lightness and perhaps solve the mystery of the universe’s observed matter - antimatter asymmetry. The postulated rare decay process of neutrinoless double beta decay ($0\nu\beta\beta$) directly probes the Dirac or Majorana nature of the neutrino. This talk will describe the challenges of searching for $0\nu\beta\beta$ decay, with an emphasis on the use of the 76Ge isotope.

Presenter: WILKERSON, John (University of North Carolina)

Session Classification: Registration

Contribution ID: 8

Type: **not specified**

The direct road to neutrino mass

Friday, 19 May 2023 14:40 (40 minutes)

The discovery of neutrino oscillations gave us proof that neutrinos have mass, a direct contradiction of the minimal standard model of particle physics. But how much mass? Oscillations cannot give a number for the mass, other than that the average of the three masses must be at least 0.02 eV. The mass is needed to build the new standard model, and to help pin down such things as the equation of state of dark energy and the evolution of structure in cosmology. KATRIN, the first new laboratory experiment on the beta spectrum of tritium in more than 20 years, has now shown the mass to be no greater than 0.8 eV. KATRIN continues toward its sensitivity goal of 0.2 eV. If the mass is not in this range, a very different approach called “Project 8” has passed proof-of-concept tests with a scheme that might have even greater sensitivity.

Presenter: ROBERTSON, Hamish (U. of Washington)

Session Classification: Registration

Contribution ID: 9

Type: **not specified**

Searching for Lepton Number and Lepton Flavor violation with cold crystals and cool muons

Friday, 19 May 2023 15:40 (40 minutes)

Presenter: KOLOMENSKY, Yury (LBNL)

Session Classification: Registration

Contribution ID: **10**

Type: **not specified**

Frank Avignone and neutrino physics

Friday, 19 May 2023 19:00 (30 minutes)

Presenter: Prof. MCDONALD, Art (Queen's University)

Session Classification: Registration

Contribution ID: 11

Type: **not specified**

A New Technique for Searching for keV/c^2 Mass Sterile Neutrinos

Friday, 19 May 2023 16:20 (40 minutes)

A new experiment to search for keV/c^2 sterile neutrinos by a deformed-beta-spectrum technique is in the final stages of construction on the USC campus. The experiment is designed to search in the mass range of a few hundred keV/c^2 to above one meV/c^2 . The technique has been simulated and shows great promise. We are convinced that if this first phase is as successful as predicted, the experiment is expandable in future versions. We will describe the apparatus in some detail and present the results of the simulations. We expect to start calibration and data runs by late summer.

Presenter: Prof. AVIGNONE, Frank (University of South Carolina)

Session Classification: Registration