The Quantum Realm and our Universe:
An introduction to the Standard Model and the elusive Neutrinos

Description: Scientists have an innate curiosity to push the boundaries of their knowledge of the universe. What else would have led them to discover particles smaller than atoms, like protons and electrons? But why stop there? What if there were even smaller particles and what if these could help explain the great mysteries of the cosmos from the Big Bang to the present day? Well, that's exactly what the field of particle physics studies. Welcome to the wacky world of subatomic quantum particles that is the subject of a vibrant and fast-growing area of physics research. This seminar seeks to introduce and illuminate exactly what this area of physics is and to further highlight the subatomic particles known as neutrinos which could answer many important questions in modern physics. An extension into the interdisciplinary nature of particle physics will also be discussed including how high school students can start to be involved in meaningful research in this field.

Prerequisites: Curiosity and an open mind!
*This is mostly a qualitative focused seminar, but a small amount of equations will be shown and basic knowledge of middle school mathematics would be useful *but not required* for short interactive activities at the end of each half of the seminar.

Date, Time, Location: Saturday Jan. 29th, noon – 2:45 EST, via ZOOM
*This class will take place over the full 2 hours and 45 minutes duration. However, we will break during the halfway point for students to leave if they wish to attend another class during the second period and for new students to come in for the second half of the seminar.

Lesson Plan:
Part 1: The Standard Model of Particle Physics and the Quantum Realm
- Historical Timeline of Particle physics – pointing out important milestones of discovery
- Introduction to quantum physics – Uncertainty, Probability, Schrödinger's Cat
- The Standard Model – nomenclature and interactive activity

* 15-minute break (1:15 – 1:30 pm EST)*

Part 2: Neutrinos and the Universe
- Introduction to Neutrinos – flavors, open questions
- Oscillations – the reason why neutrinos are so interesting
- The Big picture – dark matter, Beyond the Standard Model, STEM applications and interactive activity