Neutrino Physics

- The measurements of the neutrino masses are at the forefront in nuclear physics and in physics in general. Any finite, measured value in the energy range from 0.2 to 2.3 eV would be a major discovery.

- Our experiment addresses one of the most intriguing question in physics: how particles acquire mass ? .

- Michigan Tech in the joint effort with University of Texas at Austin , Los Alamos National Laboratory and several other universities recently proposed to build a new apparatus, NEXTEX to determine the mass of the electron antineutrino to 0.5 eV .

Astrophysics

- The field of cosmological astrophysics, the merger of cosmology, astronomy, and particle physics, will open up new insights into the nature of the universe and our existence within the next decades.

- Questions like: How many dimensions does space have; how what is the nature of Dark Energy; what is Gravity; what is the nature of those incredibly energetic cosmic rays?; are beginning to be answerable.

- Michigan Tech is well positioned to make critical contributions to these areas, with Nemiroff addressing Dark Energy, Gamma Ray Bursts, and Gravity; and Nitz & Fick pursuing the nature of Cosmic Rays.

Atmospheric Physics

- Atmospheric physics is at the heart of understanding earth's climate and how it may change in the future. One third of the global economy is directly affected by the weather so even incremental improvements in our understanding of the atmosphere provide enormous benefits to humankind.

- Questions like: What determines whether a cloud will rain; How does the energy balance of the planet depend on statistical correlations in atmospheric properties; and How do fundamental properties of water and its phase transitions influence clouds? are beginning to be answerable.

- Michigan Tech is well positioned to contribute to these areas, with Profs. Cantrell, Kostinski and Shaw addressing problems related to aerosols and clouds, ice nucleation, radiative transfer, turbulence, and weather radar.

Nanoscale Science and Engineering (NSE)

- A revolutionize field that will change the way we live. Novel products will be created atom by atom as oppose to the current top-down manner (shrinking of bulk materials).

- Solids in the scale of DNA are now five-time lighter and hundreds-time stronger than steel. Molecular-scale electronics, motors, and sensors have been identified in laboratories.

- Michigan Tech and Department of Physics (Jaszczak, Levy, Moran, Pandey, Pati and Yap) has combined strength of theoretical and experimental expertise in NSE.
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Photonics

- The field of photonic crystals, the control and manipulation of optical photons and their interaction with matter, is becoming fertile ground for novel and interesting physical phenomena such as negative refraction, slow light, the super-prism effect and photon trapping.

- Important applications include ultra-small optical devices for telecommunications and sensors.

- Michigan Tech is well positioned to make critical contributions to these areas through the work of Levy, particularly in the subfield of magnetic photonic crystals.

Computational Biophysics

- The ongoing advances in genomics and proteomics have also shown that the function of a cell cannot be understood solely by listing the constituting molecules (DNA, RNA, proteins and metabolites). Computational Biophysics and Systems Biology aim at unveiling the fundamental mechanisms in living organisms through modeling these molecules and their interaction and regulation. This allows an analysis and interpretation of genome and experimental data through modeling of molecular networks and simulation of cellular biophysics. The goal is the analysis, prediction and treatment of complex diseases at a molecular level.

- The Physics department is well positioned to make critical contributions to these areas, with the Hansmann Group studying proteins and protein interactions, and Pandey's group focusing on interaction of DNA/RNA with nanostructures.