CCSU
DEPARTMENT OF MATHEMATICAL SCIENCES

COLLOQUIUM

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2:00 – 3:00 PM
Maria Sanford, Room 101

NEGATIVE ENERGY IN AN UNUSUAL QUANTUM STATE

TOM ROMAN

CENTRAL CONNECTICUT STATE UNIVERSITY

ABSTRACT

Unlike the laws of classical physics, the laws of quantum physics allow the existence of negative energy densities and fluxes. However, unlimited amounts of negative energy could produce bizarre macroscopic effects, such as violations of the second law of thermodynamics (e.g., refrigerators without power sources). As it turns out, the same laws of quantum physics seem to place severe restrictions on how much negative energy one can have over a given period of time. More precisely, these "quantum inequalities" say that the larger the magnitude of the negative energy, the shorter its duration. Surprisingly, it is nonetheless possible to theoretically construct allowed quantum states in which an unbounded amount of negative energy can exist over an arbitrarily large region of space, at one instant of time. This talk will discuss some properties of these remarkable "Helfer states", and how they are in fact compatible with the quantum inequality restrictions. I will include *Mathematica* graphs and animations to illustrate some of the ideas, as an example of the use of *Mathematica* in research. This talk is based on recently published work done in collaboration with Larry Ford at Tufts University.

For further information:
gotchevi@ccsu.edu 860-832-2839
castanedan@ccsu.edu 860-832-2851
http://www.math.ccsu.edu/gotchev/colloquium/