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**Gregory W Moore\***, NHETC and Department of Physics and Astronomy, Rutgers University, 126 Frelinghuysen Road, Piscataway, NJ 08855. *Smooth invariants of four-dimensional manifolds and quantum field theory.*

Quantum Field Theory offers an interesting perspective on many topological and geometric invariants in mathematics. Insights from physics can lead to new and unexpected predictions about concrete mathematical quantities, predictions that are amenable to rigorous analysis. This talk focuses on the renowned example of Donaldson and Seiberg-Witten invariants in the theory of four-manifolds. In this case physics predicts an interesting equality between a path integral of an “ultraviolet” (UV) and an “infrared” (IR) quantum field theory. The physical relation between the UV and IR theories allows one to derive the relation between Donaldson and Seiberg-Witten invariants. The key to the analysis is a finite-dimensional integral called the “u-plane integral.” The talk will describe some recent insights into the u-plane integral. For all four-manifolds with  $b_2^+ = 1$  it can be identified with the constant term in the Fourier expansion of a Mock modular (or Jacobi) form. The physical approach also leads to several generalizations of the relation of Donaldson and Seiberg-Witten invariants. Finally, time permitting, a further generalization to families of four-manifolds will be described. (Received September 16, 2019)