The Geometry of Riemann's Theta Functions

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Riemann's theta functions are solutions of the heat equation that carry a tremendous amount of geometric information. Originally studied in connection with elliptic integrals, it was later realized that the zero loci of these functions, called theta divisors, carry geometric data of an associated Riemann surface. These functions have been used extensively by algebraic geometers to understand basic properties of complex projective manifolds, and more generally, solution sets of algebraic equations over an arbitrary algebraically closed field. In this talk, after reviewing some of the historical background on addition formulas for elliptic integrals, I will discuss theta functions, and the Riemann singularity theorem. Some recent results extending these classical results will also be covered. Time permitting, I will present some applications due to Clemens-Griffiths and Mumford.

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