TEMPLE UNIVERSITY

Department of Mathematics

Analysis Seminar

Room 617 Wachman Hall

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Existence of solution of an Imaging Problem in Geometrical Optics

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In recent decades, many connections, between Geometrical Optics and research in Partial Differential Equation and Differential Geometry, were noted. Most optical devices, that were designed only using paraxial approximation and ray tracing algorithms, are in fact surfaces with some geometrical properties and satisfy differential equations that can be solved explicitly using the mathematical theory. We will present in this talk a solution to the following problem. Let $\Omega, \Omega^* \subseteq \mathbb{R}^2$, and let $T : \Omega \to \Omega^*$ an injective map. The goal is to construct a lens (both surfaces are unknown) such that every ray emitted from $(x, 0), x \in \Omega$ with direction $e(x)$ leaves the lens with direction w and strikes the point (Tx, a), where a fixed real number. The first face of the lens satisfies in fact a non linear partial differential equation. We will discuss the conditions on T so that the problem has solution, and illustrate with some examples.