1012-35-29 **Nicolae Tarfulea*** (tarfulea@calumet.purdue.edu), Department of Mathematics, Purdue University Calumet, 2200 169th Street, Hammond, IN 46323. *On the Existence and Uniqueness of the Conformal Factor in General Relativity.*

Einstein's equations can be viewed as equations for geometries, that is, their solutions are equivalent classes under spacetime diffeomorphisms of metric tensors. To break this diffeomorphism invariance, Einstein's equations must be first transformed into a system having a well-posed Cauchy problem. In other words, the spacetime is foliated and each slice is characterized by its intrinsic geometry and extrinsic curvature. This decomposition allows one to express six of the ten components of Einstein's equations as a constrained system of evolution equations for the intrinsic metric and extrinsic curvature. The problem of determining a solution on the initial slice to the differential system formed by the four constraints is known as the initial data problem. Based on an older idea originated by Lichnerowicz, York and Piran describe a general method of converting the system of constraints into a system of four semilinear elliptic equations whose solution provide a foundation for prescribing the Cauchy data on the initial slice. The base of the method consists in specifying the physical data only up to conformal equivalence. In this talk, we discuss new results on the existence and uniqueness of the conformal factor in the presence of black holes. (Received July 26, 2005)