Contributed Talk

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Title: Non-aligned Einstein-Maxwell-Robinson-Trautman fields of Petrov type D

Abstract: In the quest for exact solutions of the Einstein-Maxwell equations a considerable amount of research has been devoted to the study of aligned EM fields, in which at least one of the principal null directions of the electromagnetic field F is parallel to a PND of the Weyl tensor, a so called Debever-Penrose (DP) direction. One of the main triumphs of this effort --spread out between 1960 and 1980-- has been the complete integration of the field equations (with a possible non-0 cosmological constant Λ), for the Petrov type D doubly aligned non-null EM fields, in which both real PNDs of F are parallel to a corresponding double DP vector. In a recent systematic treatment of the non-aligned algebraically special EM fields it was noted that, at least for non-0 Λ, the double alignment condition is actually a consequence of the multiple DP vectors being geodesic and shear-free. A natural question therefore arises as to whether EM solutions exist which are of Petrov type D, have $\Lambda=0$ and in which the two real DP vectors are geodesic and shear-free, but both being non aligned with the PND's of F. Recently [Class. Quantum Grav. 37, 21, 2020] we have been able to answer this question affirmatively, by completing the full integration of the EM field equations for the double Robinson-Trautman family, under the additional assumption that also the complex eigenvectors of the canonical Weyl-tetrad are hypersurface-orthogonal.