A POTENTIAL PHYSICAL CONNECTION BETWEEN THE FINITE FIELDS AND GEOMETRIC ALGEBRA.

Hampton Smith & Tatsu Takeuchi, Dept. of Physics, Va. Polytechnic Inst. & State Univ. It has been suggested that a solution to the problem of Mutually Unbiased Bases (MUBS) lies in properties of vector spaces built over the Finite Fields(Fn). Attempting this route leads to a handful of surprisingly non-trivial issues. Specifically, the abstraction of algebraic structure makes notions like distance and angles nonsensical. Analyzing these hurdles with a combination of classical projective geometry in the form of homogeneous coordinates, and methods derived from modern geometric algebra, suggests these vector spaces map to a set of Clifford algebras. The simplest geometric case (the Fano plane) presents the most difficult mathematically due to the algebra existing in characteristic 2. This case, however, interestingly appears to encode the interactions and states of a Yang-Mills type connection. Furthermore, these interactions are encoded by octonionic multiplication rules. More complex projective spaces suggest increasingly complex supersymmetric models of physics. In short, this investigation lights a path from fundamental rules of projective geometry to a descriptive toy Standard Model. Routes for further mathematical and physical research along these lines are suggested. (Supported by the National Science Foundation and Va. Polytechnic Inst. & State Univ.) Author contact: Hampton Smith, hamptonsmith@vt.edu