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On Cayley algebras over prime fields. Preliminary report.

Denote by C_p the Cayley algebra (i.e. split octonion algebra) over the field of prime order $p > 2$. We highlight some interesting features of C_p not shared by Cayley algebras over more general finite fields. For starters, the p^8 elements of C_p form a connected Cayley graph of degree 240 under the translation group, where the adjacency relation is defined by the 240 roots. We investigate the spectrum of this graph.

Our primary interest is actually more geometric than graph-theoretic. Namely, an *ovoid* in C_p is a set of elements $v_i \in C_p$ for $i \in \{1, 2, \ldots, p^3 + 1\}$ such that $v_i \cdot v_j = 0$ iff $i = j$. (No set with the latter property can have size greater than $p^3 + 1$.) Note that the definition of ovoids requires only a nondegenerate bilinear form (of maximal Witt index) rather than the full structure of the Cayley algebra. But most known constructions of ovoids in 8 dimensions make essential use of additional structure which may be conveniently viewed as arising from the algebra product of C_p. We present a conjectured formula for the number of distinct ovoids in C_p constructible by the known Cayley construction. (Received August 04, 2016)