Meeting: 1003, Atlanta, Georgia, SS 24A, AMS Special Session on Design Theory and Graph Theory, I

1003-05-89 **Omar A. Abu Ghneim*** (abugh1oa@cmich.edu), Mathematics Department, Central Michigan University, Mount Pleasant, MI 48859. *Investigation of* $(96, 20, 4)$ *Nonabelian difference sets.*

McFarland constructed difference sets with parameters $(q^{s+1}(\frac{q^{s+1}-1}{q-1}+1)$,$q^s(\frac{q^{s+1}-1}{q-1})$,$q^s(\frac{q^s-1}{q-1}))$ in abelian groups of order $q^{s+1}(\frac{q^{s+1}-1}{q-1}+1)$ which have elementary abelian subgroups of order q^{s+1}, where q here is a prime power and s is a positive integer. The McFarland construction in abelian groups has been generalized, for example, by J. Dillon, J. Davis and J. Jedwab to a much larger class of groups. As a particularly interesting case, if we take $q = 4$ and $s = 1$, we obtain the parameters $(96, 20, 4)$, the first parameter set *not* covered in Kibler's survey of difference sets. For a group G of order 96, we look at the image of difference sets in a factor group of order 32 and 24 of G. This allow us to construct $(96, 20, 4)$ difference sets in several nonabelian groups. We examine the $(96, 20, 4)$ symmetric designs obtained from these difference sets. This gives several new $(96, 20, 4)$ nonisomorphic symmetric designs. (Received August 02, 2004)