Title: Difference sets, divisible difference families and codes over Galois rings of characteristic 2^n

Abstract: An extension ring of $\boldsymbol{Z}/2^n\boldsymbol{Z}$ with the extension degree s is called a Galois ring of characteristic 2^n and denoted by $GR(2^n, s)$. $R_n = GR(2^n, s)$ is a local ring and has a unique maximal ideal $p_n = 2R_n$. Every ideal of R_n is $p_n^l = 2^l R_n, 0 < l < n$.

In this talk, we treat difference sets, divisible difference families, Reed-Muller codes over Galois rings $GR(2^n, s)$.

First, we give a family of $(2^{ns}, 2^{ns/2-1}(2^{ns/2}-1), 2^{ns/2-1}(2^{ns/2-1}-1)$ difference sets over Galois rings $GR(2^n, s)$ for even power of 2 and of any extension degrees. We notice that the difference set over $GR(2^n, s)$ is embedded in the ideal part of the difference set over $GR(2^{n+2}, s)$ when fixed an extension degree. It means that there exists an infinite family of difference sets with the embedding system over Galois rings $GR(2^n, s)$. Furthermore we show the divisible difference families can be obtained from the difference sets over $GR(2^2, s)$. Next, we define Reed-Muller codes $RM(r, s)$ of order r over $GR(2^n, s)$ similarly to the definition of Reed-Muller codes over finite fields. We can determine the minimum Lee weight of $RM(1, s)$. The Gauss sums and the estimate of character sums play an important role in proving these theorems.