Algebraic Number Theory Session, Room N–515
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# Period polynomials for finite fields of fixed small degree

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**Abstract.** Let $q$ be a power of a prime $p$, and $e$ and $f$ be positive integers satisfying $ef+1=q$. Let $F$ be the finite field of $q$ elements. The Gauss periods of order $e$ satisfy a period polynomial $P(x)$ of degree $e$ over the rational field. In the classical case $q=p$, Gauss determined $P(x)$ for $e=2,3$ and 4. Using the methods and results from the theory of cyclotomy, Dickson, Lehmer, Muskat and Whiteman, among others, determined $P(x)$ for $e=5,6,8,10,12,16$ and 24 in the case $q=p$. For the general case, Myerson determined $P(x)$ for $e=2,3$ and 4, but beyond this very little is explicitly known. Recently I determined $P(x)$ explicitly for the case $q$ is the square of $p$, when $e$ divides 8 or 12, by applying work of Berndt and Evans on Gauss sums with characters of order 6, 8 and 12. By extending their results and others to evaluate Gauss sums for arbitrary finite fields $F$ whenever e divides 24, I am able to determine $P(x)$ explicitly in the general case when $e$ divides 24. Here I am content to give this determination for $e=6$, 8 and 12.