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*Weil Sums of Binomials with Three-Valued Spectra*

Weil sums of binomials arise naturally in number theory, and have direct applications in cryptography, digital sequence design, and coding theory. Consider the Weil sum  $W_{q,d}(a) = \sum_{x \in \mathbb{F}_q} \psi_q(x^d + ax)$ , with  $\psi_q$  the canonical additive character of finite field  $\mathbb{F}_q$ ,  $\gcd(d, q-1) = 1$ ,  $d$  not a power of  $p$  modulo  $q-1$ , and  $a \in \mathbb{F}_q^*$ . Fix  $q$  and  $d$  and consider the spectrum of values obtained as  $a$  runs through  $\mathbb{F}_q^*$ . At least three values must appear, and we discuss recent results about the case where precisely three appear, including our recent proof of the characteristic 3 case of a 1976 conjecture of Helleseth.