Harmonic analysis on $GF(p^{p^\infty})$ and the corresponding Heisenberg-Weyl group

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The Pontryagin dual group $\widehat{G}$ of $GF(p^{p^\infty})$ is introduced as the inverse limit of an inverse system comprised of the $GF(p^{p^\ell})$ ($\ell \in \mathbb{Z}_0^+$), with homomorphisms between them. The properties of the profinite group $\widehat{G}$ are discussed.

Harmonic analysis on $GF(p^{p^\infty})$ is then studied. The Heisenberg-Weyl $HW[\widehat{G}, GF(p^{p^\infty}), \widehat{G}]$ group of displacements in the $GF(p^{p^\infty}) \times \hat{G}$ phase space, is shown to be a locally compact and totally disconnected topological group. The formalism introduces algebraic concepts from the theory of Galois fields into harmonic analysis. For example, transformations analogous to Frobenius transformations in Galois theory, are introduced into harmonic analysis.