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Fuglede's conjecture for groups that are the product of at most 4 cyclic groups

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A bounded measurable set $\Omega \subset \mathbb{R}^n$ is called *spectral* if $L^2(\Omega)$ has an orthogonal basis consisting of exponential functions. We say that Ω is a *tile* if there it has a tiling complement T such that almost every $x \in \mathbb{R}^n$ can uniquely be written as $x = \omega + t$, where $\omega \in \Omega$ and $t \in T$.

Fuglede conjectured that Ω is spectral if and only if it is a tile. The conjecture was first disproved by Tao, who defined a version of the conjecture for finite groups and found a counterexample using Hadamard matrices. It has been proved that the spectral-tile direction of Fuglede's conjecture holds in $\mathbb{R}$ if and only if it holds for every finite cyclic group.

We will present ideas of the proofs that Fuglede's conjecture holds for $\mathbb{Z}_{pqrs}$, $\mathbb{Z}_{p^2qr}$ and $\mathbb{Z}_p^2 \times \mathbb{Z}_q$, where p, q, r, s are different primes.