1. Selberg trace formula for $GL(2,\mathbf{F}_q)$

- Fourier Analysis on finite groups and applications, Chapter 23.

Theorem 1.1 (Selberg trace formula for finite symmetric spaces G/K)**.** *Suppose that G/K is a finite symmetric space and Γ is a subgroup of G. If f is a K-bi-invariant function on G and $\rho = \mathrm{Ind}_\Gamma^G \mathbb{1}$, then*

$$\sum_{\pi \in \widehat{G}^K} m(\pi,\rho)(\mathscr{F} f)(\pi) = \sum_{\{\gamma\}\in \Xi_\Gamma} \frac{|G_\gamma|}{|\Gamma_\gamma|} I_G(f,\gamma).$$

Definition 1.2 ($\{\gamma\}$, G_γ, Γ_γ, Ξ_γ)**.**

Definition 1.3 (Spherical transform $\mathscr{F} f$ and $\widehat{G}^K$)**.** The G-representations that appear in $\mathrm{Ind}_K^G \mathbb{1}$ (or $L^2(G/K)$) is denoted by $\widehat{G}^K$.

Definition 1.4 (Orbital sum $I_G(f,\gamma)$)**.** The orbital sum of f at γ is

$$I_G(f,\gamma) = \sum_{x\in G_\gamma \backslash G} f(x^{-1}\gamma x).$$

2. Selberg trace formula examples

- Fourier analysis on finite groups with applications, Chapter 23.
- Harmonic analysis database, $GL(2,\mathbf{F}_q)$ conjugacy classes.

2.1. $G = GL(2,\mathbf{F}_q)$, $\Gamma = GL(2,\mathbf{F}_q)$, $K = \begin{pmatrix} x & y\delta \\ y & x \end{pmatrix}$.