Black box Galois representations

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Let K be a number field and S a finite set of primes of K. Let G_K be the absolute Galois group of K and

$$\rho : G_K \to \mathrm{GL}_n(\mathbb{Q}_l)$$

be Galois representation of G_K unramified outside S. We say that ρ is presented as a *black box* representation if we only know K, S, and the characteristic polynomials of ρ at $\mathrm{Frob}_{\mathfrak{p}}$ for a finite number of chosen primes $\mathfrak{p} \notin S$.

We give a brief introduction about the information we can obtain about ρ when $n = 2$, $\ell = 3$, and how this leads to an effective 3-adic version of the Faltings–Serre method.