PART 6

THE BEAST

Remember that I said verification is relatively easy?

1D SQIsign

Verification recomputes a 2^{1000} isogeny

$$\varphi_{\text{resp}} : E_A \to E_2$$

in a number of blocks

$$\varphi_i : E^{(i)} \to E^{(i+1)}$$

All of this is done over $\mathbb{F}_{p^2}$ and requires a few essential building blocks that we know for a long time now.

- isogeny-evaluation formulas
- pairing-based techniques
- efficient basis sampling
- point compression
- curve normalisation

2D SQIsign

Verification recomputes a 2^{128} isogeny

$$E_1 \times E_2 \to F_1 \times F_2$$

in a single block.

All of this is done over $\mathbb{F}_{p^2}$, and for such "short" 2D-isogenies, we essentially only need formulas to evaluate the isogeny.

These have recently been studied by Dartois, Maino, Pope, Robert using theta-models.

(If you ever heard of Richelot isogenies between hyperelliptic curves, they are essentially the same, but different...)

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however

1

Scholten has shown in 2003 that each elliptic curve over $\mathbb{F}_{p^2}$ has a "friend" in dimension 2 over $\mathbb{F}_p$, using Weil restriction.

2

Costello has shown in 2018 that the same holds for 2-isogenies between curves! They become 2D-isogenies.