Supersingular Isogeny Key Encapsulation

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April 11, 2018

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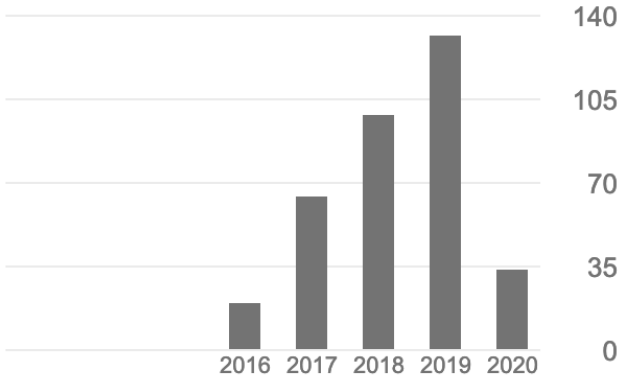

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Isogeny

From Wikipedia, the free encyclopedia

In mathematics, in particular, in algebraic geometry, an **isogeny** is a morphism of algebraic groups (a.k.a group varieties) that is surjective and has a finite kernel.

If the groups are abelian varieties, then any morphism $f : A \to B$ of the underlying algebraic varieties which is surjective with finite fibres is automatically an isogeny, provided that $f(1_A) = 1_B$. Such an isogeny f then provides a group homomorphism between the groups of k-valued points of A and B, for any field k over which f is defined.

The terms "isogeny" and "isogenous" come from the Greek word ισογενη-ς, meaning "equal in kind or nature". The term "isogeny" was introduced by Weil; before this, the term "isomorphism" was somewhat confusingly used for what is now called an isogeny.

Overview of SIDH

1. Public parameters: Supersingular elliptic curve E over F.
2. Alice chooses a kernel $A \subset E$ and sends E/A to Bob.
3. Bob chooses a kernel $B \subset E$ and sends E/B to Alice.
4. The shared secret is

$$E/\langle A, B\rangle = (E/A)/\phi_A(B) = (E/B)/\phi_B(A).$$

$$\begin{array}{ccc} E & \xrightarrow{\phi_A} & E/A \\ {\scriptstyle \phi_B}\downarrow & & \downarrow \\ E/B & \longrightarrow & E/\langle A, B\rangle \end{array}$$

Supersingular isogeny key exchange

From Wikipedia, the free encyclopedia

Supersingular isogeny Diffie–Hellman key exchange (**SIDH**) is a post-quantum cryptographic algorithm used to establish a secret key between two parties over an otherwise insecure communications channel. It is analogous to the Diffie–Hellman key exchange, but is based on walks in a supersingular isogeny graph and is designed to resist cryptanalytic attack by an adversary in possession of a quantum computer. SIDH boasts one of the smallest key sizes of all post-quantum key exchanges; with compression, SIDH uses 2688-bit[1] public keys at a 128-bit quantum security level. SIDH also distinguishes itself from similar systems such as NTRU and Ring-LWE by supporting perfect forward secrecy, a property that prevents compromised long-term keys from compromising the confidentiality of old communication sessions. These properties make SIDH a natural candidate to replace Diffie–Hellman (DHE) and elliptic curve Diffie–Hellman (ECDHE), which are widely used in Internet communication.