

# Bra-ket notation

Luigi Persico

The bra-ket notation, also called Dirac notation, is designed to make some operations of quantum mechanics easier. The notation uses angle brackets to denote vectors in a complex Hilbert space.

A **ket** is written as  $|\psi\rangle$  and represents a column vector (state vector), while a **bra**, written as  $\langle\phi|$  represents the conjugate transpose (row vector) of a ket.

The inner product (overlap) between two states is written as

$$\langle\phi|\psi\rangle,$$

and in quantum mechanics this expression is interpreted as the probability amplitude for a state  $\phi$  to collapse onto  $\psi$  (the state  $\phi$  is projected onto the state  $\psi$ ).

The outer product, which forms an operator, is written as:

$$|\psi\rangle\langle\phi|$$