

Advantages and disadvantages of ket notation - Ben Criger

In the lecture on ket notation we discussed three ways to represent quantum states: column vectors with complex coefficients, kets themselves and the geometric representation, which uses the Bloch sphere. Each one of these has their own little advantages and disadvantages, which we are going to see in the course of these videos.

First, let's take a look at some of the advantages of ket notation. So here's ket notation. Is very nice for sparse states. That is to say: states which don't have that many non-zero entries in some bases. Take for example this state here, which I will call ψ , along with most other states. It has got two nonzero terms. There is a one over root two term for the component in 00000 and a one over root two term for the all-ones as well. That would be very cumbersome to write out in a full vector, because that would require 2^5 or 32 entries, but here you can do it very compactly.

Now, if you don't have a compact state like this, if you just have some arbitrary coefficients, it can be very painstaking and time-consuming to write out something like this. Beta times 01 plus gamma times 10 plus delta times 11. Here you would be better off to use something more like a column vector. Alpha, beta, gamma, delta. And in some other times, especially if you're considering operations - transformations on the set of states - it can be beneficial to consider the Bloch sphere, where you have the reference state zero, some other states one, plus, minus and like so.