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Viktors Djakonvs

May 31, 2019

Bilde

Calculations in quantum physics make frequent use of linear operators that represent observables and specific physical notation, which is essentially different from the mathematical notation employed in the field of linear algebras and Hilbert spaces. For instance, a vector x corresponding to a pure quantum state has two names and is called either a *ket* and denoted by $|x\rangle$ or a *bra* and denoted by $\langle x|$. Inner products of vectors are called *brakets* and denoted by $\langle x | y\rangle$.

When a basis of vectors (kets or bras) is chosen, then an arbitrary state of a quantum system is represented by a linear combination of vectors from the basis. In the case of quantum information, the pair of qubit states $|1\rangle$ and $|0\rangle$ is chosen as the basis. Then an arbitrary qubit has the following mathematical representation:

$$|x\rangle = a|0\rangle + b|1\rangle$$

where a and b are the complex amplitudes of qubit states $|1\rangle$ and $|0\rangle$.

Although this is just a single unit of information, the continuous amplitudes a and b can carry an infinite amount of information, similar to analogue information carriers such as the continuous voltage stored on capacitors (cf. (Borel, 1927; 1952; Burgin, 2005; 2008)). However, this infinite information is treated as inaccessible because measurements give only one of two states $|1\rangle$ or $|0\rangle$. Even ignoring information carried by the coefficients a and b, it is possible to presume that a state of a system that stores qubit potentially contains two classical states 1 and 0. This feature of qubits (at least, theoretically) allows quantum information processing systems to achieve much higher efficiency than contemporary computers, which are based on classical information processing and work with separate digits. A collection of qubits has the potential for storing exponentially more information than a comparable collection of classical information carriers. For instance ten qubits can contain 2^{10} = 1024 bits of information as each qubit contains (in some sense) two tentative states. Quantum computers tend to process this information in a parallel way, achieving exponential speed up as 10 goes in the exponent of 2^{10}. Of course, there is a problem of extracting this information by a measurement.

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\usepackage{geometry}
\geometry{papersize={21 cm,29.7 cm}}
\geometry{top=5cm}
\geometry{bottom=7cm}
\geometry{left=5cm}
\geometry{right=5cm}
\pagestyle{empty}
\usepackage{graphicx}
\author{Viktors Djakonvs}
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\newpage\newgeometry{papersize={15cm,15cm}}
\newpage
282 \begin{center}\section*{\emph{\footnotesize
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