US 20240214191A1

(19) United States

(12) Patent Application Publication

TONG et al.

(10) Pub. No.: US 2024/0214191 A1

(43) Pub. Date: Jun. 27, 2024

(54) **METHODS AND SYSTEMS FOR A 2-QUBIT MULTI-USER QUANTUM KEY DISTRIBUTION PROTOCOL**

(71) Applicant: **HUAWEI TECHNOLOGIES CANADA CO., LTD.**, Kanata (CA)

(72) Inventors: **Wen TONG**, Ottawa (CA); **Sheng SUN**, Kanata (CA)

(73) Assignee: **HUAWEI TECHNOLOGIES CANADA CO., LTD.**, Kanata, ON (CA)

(21) Appl. No.: **18/521,368**

(22) Filed: **Nov. 28, 2023**

Related U.S. Application Data

(63) Continuation of application No. PCT/CA21/50738, filed on May 31, 2021.

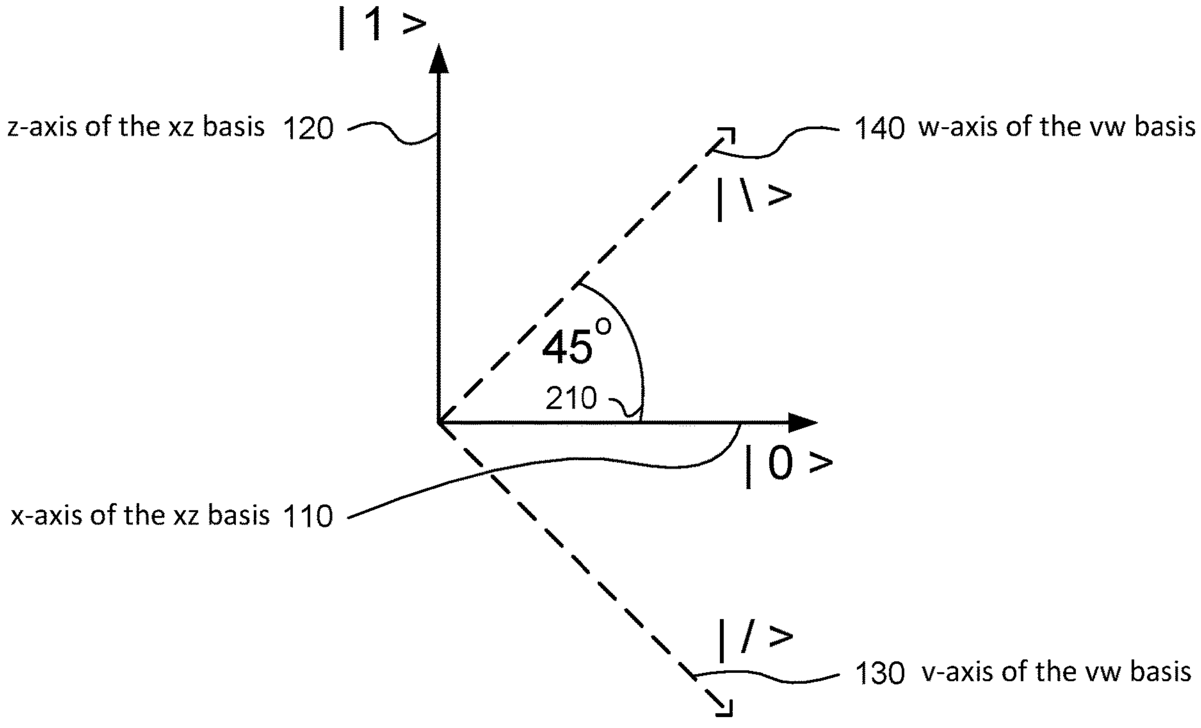
Publication Classification

(51) **Int. Cl.**
H04L 9/08 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 9/0852*** (2013.01); ***H04L 9/0819*** (2013.01)

(57) **ABSTRACT**

A method of quantum key distribution making use of 2-qubit entanglement, by which one entangled qubit is sent from an operator O to Alice and the other entangled qubit is sent from operator O to Bob, making for key-sharing among three parties (multi-user quantum key distribution, i.e. MU QKD). Alice and Bob each measures a respective sequence of qubits randomly along either one of two states, records the measurements in a respective list, and encodes the bits in an encoded list. The encoded lists are sent to operator O for entanglement to be verified with the CHSH inequality. Bob's verified list is sent to Alice and vice-versa, allowing Alice and Bob to further verify correlation. Non-entangled bits are rejected until Alice and Bob have a similar key, being a reconciled quantum-based key as sought.


| 1 >
z-axis of the xz basis 120
140 w-axis of the vw basis
| \ >
45°
210
| 0 >
x-axis of the xz basis 110
| / >
130 v-axis of the vw basis