量子电子学报 2013, 30(3) 310-313 DOI: ISSN: 1007-5461 CN: 34-1163/TN

量子光学

利用5粒子纠缠态实现四粒子w态的量子信息的分离

蒋忠胜 吕洪君 解光军

合肥工业大学电子科学与应用物理学院，安徽 合肥 230009

摘要： 提出了一种利用五粒子纠缠态作为量子信道，实现四粒子w态的量子信息的分离。发送者Alice发送2、5粒子给Bob，发送3粒子给Charlie。Alice对手中的六个粒子进行von-Neumann测量，把测量结果告诉Charlie和Bob，控制者Charlie对手中的单粒子进行投影测量，再把测量结果告诉Bob，Bob根据手中结果对手中的二粒子进行适当的幺正变换，加两个辅助粒子，再进行适当的量子门操作，就可重建欲发送的四粒子w态，该方案成功概率100%，而且传输粒子较少，易于实现。

关键词： 量子光学 量子信息分离 von-Neumann测量 四粒子w态 量子信息

Quantum Information splitting of four particle w state by using five entangled particle state

JIANG Zhong-sheng，lV Hong-jun，XIE Guang-jun

School of Electronic Sciences and Applied Physics，Hefei University of Technology，Hefei 230009，China

Abstract: A scheme of put forward a project using a five-particle entangled state as quantum channel, which can achieve the separate of quantum information of four particles w state. The sender Alice sends 2，5 particles to Bob and Send 3 particles to Charlie. The sender Alice conduct von-Neumann measurement to six particles in hand and tell Charlie and Bob measurement results. The controller Charlie make projection measurement to single particle in hand, then tell Bob of the measure result. According to the results ,Bob make the appropriate operating of unitary transformation to two particle, plusing two auxiliary particles, conducting the appropriate operation of quantum gates .Through all of this operations Bob can rebuild four particle w state which is to be sent . The success probability of this project is 100%,what’s more , it needs less particles and is easier to be accomplished.

Keywords: quantum optics separate of quantum information measure of von-Neumann four particle W state quantum information

收稿日期 2012-04-19 修回日期 2012-06-15 网络版发布日期 2013-05-10

DOI:

基金项目:

安徽省自然基金项目（1208055MF102），国家大学生创新实验计划项目（111035948）资助

通讯作者: 吕洪君（1958-）硕士，副教授，硕士生导师，研究方向为量子光学和量子计算。

作者简介: 蒋忠胜（1992-），安徽人，研究方向为光电子学和量子光学，E-mail：1028640197@qq.com

作者Email: lvhongjun1958@sina.com

参考文献：

Bennett.C.H.Brassard.G..Crepeau.C.Jozsa.R.Peres.A..Wootters.W. K.Teleporting an unknown quantum state via dual classical and Einstein-Podolsky-Rosen channels[J] .Phys. Rev. Lett. 1993, 70 :1895~1899.

Bouwmeester D.Pan JW.Mattle K.et al.Experimental quantum teleportation [J].Nature. 1997, 390 (6660) :575-579.

Boschi D.Branca S. De Martini F.Hardy L.Popescu S. Experimental realization of teleporting an unknown pure quantum state via dual classical and Einstein-Podolsky-Rosen channels[J] .Physical Review Letters.1998, 80 (6) :1121-1125.

LING Rui-liang.FENG Jin-fu.Quantum Teleportation of Two-particle Entangled State(EPR PAIR) [J] Acta Sinica Quantum Optica量子光学学报.2009.15(4).347-351（in chinese）

ZHOU Rui.ZHU Yu-lan. NIE Yi-you. One-way Communication Scheme Based on Superdense Coding of Four Dimension Two Particles[J]. Acta Photonica Sinica光子学报.2010.39(1):156-159(in chinese）.

ZHANG Guang-yu.MA Jing,TAN Li-ying. Study on quantum key bit rate in free-space quantum cryptography[J]. Chinese Journal of Quantum Electronics.量子电子学报2005.22(06):868-872（in chinese）.

Bouwmeester D.Pan JW.Mattle K. Eibl M. Weinfurter H.Zeilinger A. Experimental quantum teleportation [J].Nature.1997.390:575-579.

Li Yan-Ling. Feng Jian. Teleportation of arbitrary three-particle GHZ state using single three-particle maximal GHZ state or two EPR states[J]. Acta Physica Sinica物理学报.2007. (04): 1888-1894（in chinese）.

Hou. K, Li. Y.B. Shi. S.H. Quantum state sharing with a genuinely entangled five-qubit state and Bell-state measurements[J]. Opt. Commun.2010. 283(9):1961－1965.

Yan .F.L.,Wang. D. Probabilistic and controlled teleportation of unknown quantum states[J]. Phys. Lett.A 2003.316(5):297－303.

Guy Bensky .Robert Amsüss. Johannes Majer .David Petrosyan . J?rg Schmiedmayer . Gershon Kurizki Controlling quantum information processing in hybrid systems on chips[J] Quantum Inf Process .2011.10:1037－1060.

F F Fanchini. L K Castelano. M F Cornelio etal Locally inaccessible information as a fundamental ingredient to quantum information[J].New Journal of Physics.14： 013027.

Zheng Yi-Zhuang.Dai Ling-Yu.Guo Guang-Can.Teleportation of a three-particle entangled W state through two-particle entangled quantum channels[J]. Acta Physica Sinica物理学报.2003.52(11):2678-2681（in chinese）.

LI Yuan-hua.LIU Jun-chang.NIE Yi-you.Quantum Information Splitting by Using a Genuinely Entangled Six-qubit State and Bell-state Measurements[J].Acta Photonica Sinica光子学报.2011.(02):307-310（in chinese）.

LIU Kun.LI Yuan-hua.LIANG Zhang-tan.etal.Controlled Quantum Teleportation via Six-Qubit Cluster State [J].Journal of Jiangxi Normal University江西师范大学学报(自然科学版).2010.(06):612-614.（in chinese）.

PAN Gui-Xia.Quantum information splitting of arbitrary two-particle state using two GHZ states [J].Chinese Journal of Quantum Electornics 量子电子学报2010.27(5):573-579（in chinese）.

Yi-you Nie.Yuan-hua.Li,Jun-chang Liu,et al .Quantum information splitting of an arbitrary three-qubit state by using two four-qubit cluster states[J].Quantum Inf Process.2011.10:297-305.

本刊中的类似文章

1．朱勋 王干全.一种新的关于两电子纠缠的判据[J]. 量子电子学报, 2009,26(3): 297-300

2．石市委 易佑民 .使用共振腔实现受控非门及量子隐形传态的方案[J]. 量子电子学报, 2009,26(3): 301-305

3．邹艳.V型三能级原子与双模奇偶纠缠相干光场相互作用的量子态保真度[J]. 量子电子学报, 2009,26(3): 320-326

4．臧学平 杨名.二项式光场中运动的Ξ型三能级原子偶极振幅平方压缩[J]. 量子电子学报, 2009,26(3): 327-332

5．王帅 .数-相量子化及介观电路在自由热态下的量子效应[J]. 量子电子学报, 2009,26(3): 333-337

6．黄正逸 金铱 马骥 徐雷 陈宪锋.一维光子晶体的全向反射特性[J]. 量子电子学报, 2009,26(3): 338-341

7．张仲 周波 王培吉 陶冶薇.各向异性n维耦合谐振子能量本征值的代数解法[J]. 量子电子学报, 2009,26(4): 405-412

8．周锐 朱玉兰 聂义友 黄亦斌.不完全依赖仲裁的量子签名协议[J]. 量子电子学报, 2009,26(4): 442-445

9．李冬梅.利用线性光学器件实现三体纠缠相干态的纠缠交换[J]. 量子电子学报, 2009,26(4): 446-450

10．杨庆怡 易施光.普遍意义下介观RLC并联电路的量子化及在真空态下的量子涨落[J]. 量子电子学报, 2009,26(4): 451-455

11．额尔敦朝鲁 王宝昌.温度对非对称量子点中强磁耦合极化子声子平均数的影响[J]. 量子电子学报, 2009,26(4): 477-481

12．胡桂玉 杨振 叶柳.在离子阱中实现量子SWAP门的方案[J]. 量子电子学报, 2009,26(5): 555-559

13．唐世清 张登玉 高峰 谢利军 詹孝贵.在双模腔QED系统中用原子-腔共振相互作用实现三量子比特Toffoli门[J]. 量子电子学报, 2009,26(5): 548-554

14．吴张斌 陈光 杨伯君.基于BBM92协议的量子密钥分发系统改进方案[J]. 量子电子学报, 2009,26(5): 560-564

15．熊狂炜 艾剑锋.利用非最大纠缠态实现未知原子态的受控传递[J]. 量子电子学报, 2009,26(5): 565-569