Super Distance Communication with Quantum Entanglement

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Abstract:Super distance communication with quantum packet selection and grouping plus interval correction

Keywords:Super distance communication Quantum entanglement Quantum communication Quantum grouping Interval to send

According to the nature of the quantum entanglement we have now determined, the following method can be used to achieve the super distance communication based on light years distance.
This method can be called a packet selection plus interval correction method.
The quantum in the entanglement is in the superimposed rotational state, and if it is observed, it becomes the rotational state, left rotation or right rotation. At first I would like to introduce some of the necessary concepts. First the side who send the message first will be called the originator, the side who receive the message will be called the receiver.Then we know,the quantum in the entanglement is paired ,which include 2 light quantum, which is called 1 pair of quantum.For this paired quantum,the originator and receiver must keep 1 light quantum respectively for communication.
The first step is to group the light quantum, 2 pairs of entangled quantum constitute a group,so the group include 4 light quantum. Such a group in the originator and receiver, respectively, there are 2 light quantum for each side. If you observe this group of quantum, then the two sides have the three following possible results: double left rotation, double right rotation, left and right rotation. For the sake of convenience we compiled them as AA(double left rotation), BB(double right rotation), AB(left and right rotation).The second step will be compiled for each of the three groups of quantum,we call the 3 groups as a round. For the observation of a round,the originator and receiver will observe 6 light quantum respectively.The result for each round will be like this:AA,BB,AB or AB,BA,AB etc.This observation of a round, you may have a variety of results. We will set two of these results as valid results,named valid round. One is the round of the emergence of two AA combination named dual AA, the other is the round of the emergence of a combination of two BB named dual BB. Therefore,we got the following 6 valid round,they are:AA, AB, AA and AB, AA, AA, and AA, AA, AB ; the same way BB, BB, AB and BB, AB, BB and AB, BB, BB. In addition to the 6 valid combinations above, the rest are invalid combinations, named invalid round. For example: AB, AA, AB or AB, AB, BB and so on. In addition, such as AA, AA, AA and BB, BB, BB there are three AA or 3 BB, also invalid round. Invalid rounds both by default, means this round of observation consist no information and should be ignored.In the third step, there are three sets of quantum in turn. For example, AB, AA, AA this valid round, the first group of AB combination we named as invalid group.The AA and BB we named valid group. Note that a valid round must have and only have a group of AB, that is to say,an invalid group. A valid round consists of a set of invalid group AB plus two valid groups of AA or BB. It is necessary for us to find the invalid group AB when we analyze a valid round.We must determine the sequence order of an invalid group of

AB.Which is to say, whether the AB combination is appeared in the first order, second order or third order in this round. Such as AB, AA, AA in this round ,the invalid AB’s sequence order is 1; AA, AB, AA this round ,the invalid AB’s sequence order is 2; AA, AA, AB this round ,the invalid AB’s sequence order is 3.
Some of the basic concepts described above are completed. Now suppose that a spacecraft is starting from the earth, after many years, this spacecraft is 1000 light years away from us. We must communicate with this spacecraft. We will set the spacecraft as originator, which is the first party to send information, the Earth side as the receiver. This setting is necessary, otherwise it will lead to chaos.For the communication between the originator and the receiver (that is, the spacecraft and the earth) to proceed smoothly,we must meet the following conditions.

First, before departure, the two sides agreed to the specific frequency of communication with each other, this specific time is very important to be accurate to the second. For example, to determine the two sides a communication time each year, the time is in January each year, zero o'clock, that is, 00:00:00, zero minutes and seconds.Odd year,the spacecraft play as originator. Even year the Earth play as originator. The two sides to carry out such a specific frequency of communication and specific time setting is necessary. We will name these pre-agreed communication days(00:00:00 in January) as fixed communication days.
In addition to such a fixed communication, by the two sides in each round of fixed communication agreed to a specific time for non-fixed communication. Note that each communication must be agreed in advance, this can not be changed.
Second, based on the above requirements, spacecraft and the Earth must have a unified time measurement system. Because the agreed time must be the Synchronized, otherwise the communication can not be carried out. Time to be accurate to the second, of course, now the technology has been able to achieve this.
Here we assume that the two sides have a unified timing of the time measurement system.
Third, the communication requirements for the communication of the quantum code grouping and sort order. Before departure, the spacecraft shall carry the quantum used for future communication, which must have been grouped and sort ordered. We assume that the spacecraft and the earth to carry out 10,000 communications, assuming that we are now in communication mode, each communication to consume about 30 million pairs of quantum, then 10,000 communications to be 3 billion pairs of quantum. The 3 billion pairs (6 billion light quantum) must be coded and sort ordered.Before the departure,the Earth and spacecraft carrying 3 billion light quantum respectively. This quantum can not be added half-way.

How to sort the 30 billion quantum code? This is a very important procedure. Communication ten thousand times, then each time to be 300,000 pairs of quantum, each time the 300,000 pairs of quantum to be separated and from 1 to 10000. Each 30 million pairs of quantum is set to a communication round. If the number of 30 million quantum is lost for a big amount, then this round of communication can not be carried out, but does not affect the other round of communication. Why 30 million quantum for a round,because of the communication mode I used. It is only the beginning to encode every 30 million quantum. Now I need to introduce the communication mode, because all the coding sort depends on the communication mode. We said above a <u>group</u> include two pairs of quantum, three groups constitute a <u>round</u>. Now set as this, every minute by the originator to observe a group of 2 light quantum first.Set this is the case, in this minute, the first 40 seconds by the originator to observe the 2 light quantum they have, the remaining 20 seconds by the receiver to observe 2 light quantum they have. For example, the agreed communication time, 00: 00: 00 both sides go to the communication room. 00:00:00 to 00:00:40 this time period for the originator to observe the 2 quantum they have, and record the results. And this time period, the receiver can not take action, can not observe their quantum. The receiver waits until 00:00:41 to 00:00:60, which is the time period that the receiver observes the 2 light quantum they have and records the results. This is the process of a minute. As mentioned earlier, a round consist 3 groups of quantum, it takes 3 minutes, consuming 6 pairs of quantum(12 separate light quantum). After each round of observation, we set an interval, rest for a few minutes.

Now we need to handle the sequence order of the invalid group AB.After each round of observation, we set an interval.For an invalid round we set the interval of 1 minute.For the valid round we set the interval depend on the sequence order of the invalid group of AB. We set the interval as:sequence order NO.+1 minute.

For example:the valid round AA, AB, AA,the sequence order NO. Is 2,then we got an interval of 2+1 minutes.That is to say, after the current round of observation the originator will wait 3 minutes before observing the next round. Why should we set such an interval? This is to exclude the impact of random factors. As this round, the originator observed the result as AA, AB, AA, then the receiver will observe the result as BB, AB, BB. So the receiver know AB appear in the sequence order 2, they can also calculate the interval is 2+1, the originator will rest for 3 minutes, their own side also have to wait 3 minutes to observe the next round.

So count as above, three minutes to observe the three groups of quantum plus a minute interval, normally a round takes 4 minutes.

Every hour can be carried out 15 rounds, every 2 hours 30 rounds. We set 30 rounds as a <u>section</u>. There are 30 rounds, to consume 180 pairs of quantum. In each of our section (2 hours) can send a BIT, that is, a 1 or 0, that is, 180 pairs of quantum to send a BIT.

Now, we set to send a section of information in the following order: 1. Dual AA, 2. Double BB, 3. Dual AA, 4. Dual AA, 5. Double BB. Now to the agreed communication time, such as Year 3XXX January 1 at zero o'clock. 00:00:00 both sides go to the communication room. The communication process is as follows:

1.00: 00: 00 to 00:00:40 The originator observes that the two qubits of the local end are AB. 00:00:41 to 00:00:60 receiver to observe the end of the two quantum AB.

2.00: 01: 00 to 00:01:40 The originator observes that the two qubits of the local end are AB. 00:01:41 to 00:01:60 Receiver to observe the end of the two quantum AB.

3.00: 02: 00 to 00:02:40 The originator observes that the two qubits of the local end are AA. 00:02:41 to 00:02:60 receiver to observe the end of the two quantum BB.

This completes the first round of three groups of observations, the originator results AB, AB, AA, the receiver results AB, AB, BB. Regardless of the originator or the receiver are aware of this round does not appear dual AA, so it’s invalid round, the two sides to rest for 1 minute before starting again.

Now the new round starts:

1.00: 04: 00 to 00:04:40 The originator observes that the two qubits of the local end are BB. 00:04:41 to 00:04:60 receiver to observe the end of the two quantum AA.

2.00: 05: 00 to 00:05:40 The originator observes that the two qubits of the local end are AB. 00:05:41 to 00:05:60 receiver to observe the end of the two quantum AB.
3.00: 06: 00 to 00:06:40 The originator observes that the two qubits of the local end are BB. 00:06:41 to 00:06:60 receiver to observe the end of the two quantum AA.
This completes the observation of the second round of the three groups, the originator results BB, AB, BB, the recipient results AA, AB, AA. Regardless of the originator or the receiver are aware of this round of dual AA, so it is a valid round, the first two AA of this section has been sent to the receiver. And the sequence order NO.of the invalid AB is 2, so 1 +2 is equal to 3, both sides understand that the interval is 3 minutes. In accordance with the previously agreed order: 1. Dual AA, 2. Double BB, 3. Dual AA, 4. Dual AA, 5. Double BB, 6. Double BB. The next round, the originator need to send the double BB.
Let us start the new round:
1.00: 10: 00 to 00:10:40 The originator observes that the two qubits of the local end are AB. 00:10:41 to 00:10:60 receiver to observe the end of the two quantum AB.
2.00: 11: 00 to 00:11:40 The originator observes that the two qubits of the local end are AA. 00:11:41 to 00:11:60 receiver to observe the end of the two quantum BB
3.00: 12:00 to 00:12:40 The originator observes that the two qubits of the local end are AA. 00:12:41 to 00:12:60 receiver to observe the end of the two quantum BB.
This completes the observation of the third round of the 3 groups, the originator results AB, AA, AA, the receiver results AB, BB, BB. Regardless of the originator or the receiver are aware of this round of double BB, so it is a valid round.The first two BB of this section has been sent to the receiver. And the sequence order NO.of the invalid AB is 1, so 1 +1 is equal to 2, both sides understand that the interval is 2 minutes. In accordance with the previously agreed order: 1. Dual AA, 2. Double BB, 3. Dual AA, 4. Dual AA, 5. Double BB, 6. Double BB. The next round, the originator need to send the dual AA.
Well, so far has been carried out three rounds, sent 1. double AA, 2. Double BB. We still need to send the remained 3. Dual AA, 4. Dual AA, 5. Double BB, 6. Double BB for a complete section.Basically the pattern of the process has come out, the following 3. double AA, 4. double AA, 5. double BB, 6. double BB could be sent as the above pattern.
We mentioned before that we set 2 hours as a section. 2 hours(120 minutes), it must be equipped with 180 pairs of quantum to prepare for a section communication. Now according to the above model in 2 hours we passed a valid message,that is: 1. Dual AA, 2. Double BB, 3. Dual AA, 4. Dual AA, 5. Double BB, 6. Double BB. Then what is the meaning of this message? The recipient received this message to understand that this message is not come from chaos. It was sent after human manual selection. In accordance with the binary code, this 2 hours of message can only be encoded as a 1 or a 0. For the time being we encode this human manual selection message as 1. Yes, that is so inefficient, one section(2 hours) can only send a 1 or a 0, But taking into account that this may be hundreds of thousands of light years between the transmission of information, this efficiency is also acceptable.
Now we have encoded a binary 1, then how about the 0? Easy to handle, in the next 2 hours, At the beginning 40 seconds,the originator observe all the 180 quantum. That is, at Year 3XXX January 1, 02:00:00 to 02:00:40 the originator will observe all the 180 quantum in one time.So the receiver will realize:the message are chaos and could not be decoded.Then the chaos in these 2 hours we encoded as a 0.And then analogy can be followed by binary code to enter. Line information is transmitted, and

this is the information transmission.

Conclusion: The model exemplified here is not necessarily optimal, and it is possible to make various changes. It is important that the idea of sending quantum packets and interval is decisive. Of course, can not rule out the future there are other more effective way.

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以量子纠缠实现的超距通讯

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摘要:以分组择定加间隔修正法实现的超距通讯

关键词:量子分组 间隔发送 超距通讯 量子纠缠 量子通信

根据量子纠缠的性质，我们现在确定了以下方法可以实现基于光年距离的超距离通信。该方法可以称为分组选择加间隔校正方法。

缠结中的量子处于叠加的旋转状态，如果观察到的话，其变为旋转状态，左旋转或右旋转。起初我想介绍一些必要的概念。首先发送消息的一方将被称为发起方，接收消息的一方将被称为接收方。然后我们知道纠缠中的量子是配对的，其中包括 2 个光量子，称为量子对。对于这个配对的量子对，发起者和接收者必须分别保有 1 个光量子用于通信。

第一步是对光量子进行分组，2 对纠缠状态的量子对构成一个量子组，因此该量子组包括 4 个光量子。这样一个量子组在发起者和接收者中分别有两个光量子被保存在每一方。如果观察这个量子组，那么双方有三个可能的结果：双左旋转，双右旋转，左右旋转。为方便起见，我们将它们编译为 AA（双左旋转），BB（双右旋转），AB（左右旋转）。第三步对三组量子再进行编译，我们将 3 组编为一轮。

第二步是对每一轮量子的观察结果进行区分，分别出有效轮和无效轮。为了观察一轮，发起者和接收者将分别在己方观察 3 个量子组，也就是 6 个光量子。每轮将有如下所示的可能结果：AA，BB，AB 或 AB，BA，AB 等。一轮的观察，你可能有各种不同的结果。我们将把以下两个结果作为可以传递信息的有效结果看待，命名为有效轮。其一是在一轮中有 2 个 AA 组合的出现，命名为双 AA，其二是在一轮中有 2 个 BB 组合出现的一轮命名双 BB。因此，我们得到以下 6 个有效轮次：AA，AB，AA 和 AB，AA，AA 和 AA，AA，AB; 以及 BB，BB，AB 和 BB，AB，BB 和 AB，BB，BB。除了上述 6 种有效组合之外，其余都是无效组合，命名为无效轮。例如：AB，AA，AB 或 AB，AB，BB 等。另外，如 AA，AA，AA 和 BB，BB，BB 有三个 AA 还是 3 个 BB，也是无效的。默认情况下无效的轮，意味着这轮观察不包括信息，应该被忽略。

第三步是关于无效量子组的组序确定。如上所定，每一轮中的三组量子是按照先后顺序依次排列的。例如，AB，AA，AA 这个有效轮，第一组 AB 组合我们命名为无效量子组。AA 和 BB 我们命名为有效量子组。请注意，有效的轮必须具有且只有一组 AB，也就是说一个无效的组。有效轮由一组无效组 AB 加上两个有效的 AA 或 BB 组组成。当我们分析一个有效的轮时，我们有必要找出无效的那一组 AB 并确定其所在的顺位。我们必须确定 AB 这个无效量子组在本轮中的顺序。也就是说，AB 这个无效的组合是出现在本轮第一，第二，还是第三顺位，我们将这个顺位命名为无效组合 AB 的组序。如 AB，AA，AA 在本轮中，无效量子组 AB 的顺序为 1; AA，AB，AA 本轮，无效量子组 AB 的顺序为 2; AA，AA，AB 这一轮，无效量子组 AB 的顺序为 3。

上述一些基本概念已经完成。现在假设一艘航天器从地球开始，经过多年，这艘航天器离我们 1000 光年。我们必须与这个航天器通信。我们将航天器作为发起者，这是发送信息的一方，地球一方作为接收方。这种设置是必要的，否则会导致混乱。对于发起者和接收者（即航天器和地球）之间的通信顺利进行，我们必须满足以下条件。

首先，在出发前，双方约定具体的沟通时间与频率，这个具体时间是非常重要的，需要准确到秒。例如，双方确定每年的第一轮沟通时间，具体时间为每年 1 月 1 日零点零分和零秒，

即某年 1 月 1 日 00:00:00。奇数的年份，航天器作为发起人。偶数的年份地球作为发起人。双方进行这种具体的沟通频率和具体的时间设置是必要的。我们将这些预先约定的通信日期（例如 XX 年 1 月 1 日的 00:00:00）命名为固定通信日。除了这样的固定通信外，由双方可在每一轮固定通信中再行约定一个具体时间进行非固定通信。注意，每个通信必须提前约定，这不能改变。

第二，基于上述要求，航天器和地球必须有统一同步的时间度量系统。因为约定的时间必须是同步一致的，否则无法进行通信。并且时间要准确到秒，当然现在的技术已经能够实现了。

这里我们假设双方都有统一的时间测量系统。

第三，通信要求对所有用于通信的光量子进行分组和排序。在出发前，航天器应携带用于将来通信的量子，必须对其进行分组和排序。我们假设航天器和地球需进行 10,000 次通信，假设我们现在处于通信模式，每一轮次通信需消耗大约 30 万的量子组，那么 10,000 个通信量就是 30 的量子组。 30 亿个量子组（120 亿个光量子）必须各自编码和排序。离开之前，地球和航天器分别携带 60 亿个光量子。这个量子不能在途中被添加。

如何排序 30 亿的量子组？这是一个非常重要的程序。通信万次，然后每轮次要 30 万量子组，每轮次 30 万量子组被分离，从 1 到 100000.每 30 万的量子组被设置为一个通信轮次。如果这一轮次 30 万的量子组大量丢失，那么这轮次通信不能进行，但不影响其他轮的通信。为什么 30 万的量子组构成一个轮次，这是由我们所采用的以下特大的通信模式所决定。现在介绍这个特定的通信模式，因为所有的编码排序都取决于此通信模式。我们上面说的一组包括两对量子，三组构成一轮。现在这样设定，每一分钟由发起者首先观察一组 2 个光量子，发起者观测后，再由接收者观测。以下是具体程序，在这一分钟内，前面的 40 秒内发起者观察他们拥有的 2 个光量子，剩下的 20 秒由接收者观察他们拥有的 2 个光量子。例如，约定的通信时间到了，某年的 1 月 1 日的 00：00：00，双方都进入通信室。 00:00:00 至 00:00:40 这个时间段发起人观察他们拥有的 2 个量子，并记录结果。而这个时间段，接收者不能采取行动，不能观察他们那端的量子。接收者要等待到 00:00:41 至 00:00:60，这是接收者观察他们拥有的 2 个光量子的时间段，并记录结果。这是一分钟的过程。如前所述，每轮由 3 个组量组组成，需要 3 分钟，消耗 6 对量子（12 个单独的光量子）。每轮观察后，我们设置一个间隔，休息几分钟。

现在我们需要处理无效组 AB 的顺序，也就是上文提到的组序。经过一轮观察，我们设置了一个间隔。对于无效轮，我们设置 1 分钟的间隔。对于有效循轮，我们设置的间隔取决于本轮的无效组 AB 的组序。我们将间隔设置为：组序号 NO。+ 1 分钟。

例如：有效轮次 AA，AB，AA，AB 的组序号 NO。是 2，那么我们得到 2 + 1 分钟的间隔。也就是说，在本轮观察之后，发起者将等待 3 分钟，然后观察下一轮。为什么要设置这样的间隔？这是排除随机因素的影响。在本轮中，发起人将观察到结果为 AA，AB，AA，接收者将观察到结果为 BB，AB，BB。所以接收方也可以知道本轮中 AB 这个无效量子组的排列顺位也就是组序为 2，他们也可以计算出间隔为 2 + 1，由此推断出发起者将休息 3 分钟，自己也要等 3 分钟再观察下一轮。

所以如上述计算，三分钟观察三组量子加上一分钟的间隔，通常一轮需要 4 分钟。

以此类推每小时可进行 15 轮，每 2 小时 30 轮。我们把 30 轮作为一个通讯节。则一节有 30 轮，消耗 180 对量子。则我们每个部分（2 小时）可以发送一个 BIT，即 1 或 0，即 180 对量子发送一个 BIT。

现在，我们设置按以下顺序发送一节信息：1.双 AA，2.双 BB，3.双 AA，4.双 AA，5.

双 BB。现在到了约定的沟通时间，比如 3XXX 年 1 月 1 日的零点零分零秒 00:00:00，双方前往通讯室。通信具体过程如下：

1.00：00：00 至 00:00:40 发端人观察到本端的两个量子结果为 AB。 00:00:41 到 00:00:60 接收者观察两个量子结果为 AB。

2.00:01:00～00:01:40 发端人观察到本端的两个量子结果为 AB。00:01:41 到 00:01:60 接收者观察两个量子结果为 AB。

3.00：02：00 至 00:02:40 发端人观察到本地的两个量子结果为 AA。 00:02:41 到 00:02:60 接收器观察两个量子结果为 BB。

这完成了第一轮三组观察，发起者结果 AB，AB，AA，接收结果 AB，AB，BB。无论发起人或接收者皆知道这轮没有出现双 AA，所以是无效的一轮，双方休息 1 分钟才能再次开始。

现在新一轮开始了：

1.00：04：00 到 00:04:40 发端人观察到本地的两个量子结果为 BB。 00:04:41 到 00:04:60 接收器观察两个量子结果为 AA。

2.00：05：00 到 00:05:40 发端人注意到本端的两个量子结果为 AB。 00:05:41 到 00:05:60 接收器观察两个量子结果为 AB。

3.00:06:00～00:06:40 发端人观察到本地的两个量子结果为 BB。00:06:41 到 00:06:60 接收器观察两个量子结果为 AA。

这完成了第二轮观察，发起人结果 BB，AB，BB，收件人结果 AA，AB，AA。无论发起者还是接收者都知道这一轮出现了双 AA，所以这是一个有效的回合，本节的前两个 AA 已经发送给接收者。而无效的 AB 组的序列号也就是组序为 2，所以 2+1 等于 3，双方都知道间隔为 3 分钟。按照以前约定的顺序：1.双 AA，双双 BB，3.双 AA，4.双 AA，5.双 BB，6.双 BB。下一轮，发起人需要发送双 BB。

让我们开始新一轮：

1.00：10：00 到 00:10:40 发端人观察到本端的两个量子结果为 AB。 00:10:41 到 00:10:60 接收器观察两个量子结果为 AB。

2.00：11：00 至 00:11:40 发起人观察到本地的两个量子结果为 AA。 00:11:41 到 00:11:60 接收器观察两个量子结果为 BB。

3.00：12:00 至 00:12:40 发端人观察到本端的两个量子结果为 AA。 00:12:41 到 00:12:60 接收器观察两个量子结果为 BB。

这完成了观察第三轮的 3 组，发起者结果 AB，AA，AA，接收者结果 AB，BB，BB。无论发起者还是接收者都知道这一轮出现的双 BB，所以它是一个有效轮。本节的前两个 BB 已经发送到接收者。而无效的 AB 组的序列号也就是组序为 1，所以 1 +1 等于 2，双方都知道间隔为 2 分钟。按照以前约定的顺序：1.双 AA，双双 BB，3.双 AA，4.双 AA，5.双 BB，6.双 BB。下一轮，发起人需要发送双 AA。

那么，到目前为止已经进行了三轮，传送了一个双 AA，2.双 BB。我们还需要发送剩余的 3.双 AA，4.双 AA，5.双 BB，6.双 BB 这几个余下的部分。过程的模式已经出来了，以下 3.双 AA，4。双 AA，5.双 BB，6.双 BB 可按上述模式发送。

我们之前提到过，我们把两个小时作为一个通信节。2 小时(120 分钟)，它必须配备 180 个量子对来预备一段通信。根据上面两个小时的模型，我们传递了一条有效的信息，那条信息就是:1。双 AA,2。双 BB,3。双 AA,4。双 AA,5。双 BB,6。双 BB。那么这条信息的意义是什么呢?接受者收到这条消息可以清楚地理解这条信息并非来自于无序混乱的随机观察结果，而是在人类人工选择之后发送的结果。根据二进制代码，这两个小时的消息可以被编码为 1 或 0。目前，我们且将这个人工选择的信息编码为 1。是的，这是非常低效的，一个通信节(2 小时)

只能发送一个 1 或 0，但是考虑到这可能是在数十万光年或更长距离之间的信息传输，这种效率也是可以接受的。

现在我们已经编码了二进制的 1，那么 0 呢?很容易处理，在接下来的一个通信节（2 个小时）里，在开始的 40 秒内，发起人观察所有的 180 个光量子。也就是说，在 1 月 1 日，02:00:00 至 02:00:40，发起人将同时观察所有 180 个光量子。因此，接收者会意识到:信息是混乱的，不能被解码。那这两个小时的混乱无法解读出明显人工择定的迹象的观测结果，我们编码为 0。然后可以以此类推依次用二进制代码来输入进行信息传输。

结论:这里的通信模型本身并不一定是最优的，并且有可能做出各种各样的改变。重要的是，编组并按轮发送量子包加上依据组序进行间隔休息的这一思路是决定性的。当然，亦不能排除随技术的进步未来会有其他更有效的方法。

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