

Exercises

1- Consider a BB84 quantum cryptography system which employs attenuated laser pulses as the source of Alice's photons.

(a) explain how Alice can produce photons with a particular polarization angle by placing suitable linear optical components after the laser.

(b) Devise a scheme for producing a stream of single photons with their polarization angles switching between angles 0° , 45° , 90° or 135° at choice by combining four such laser beams (Assume that Alice can turn the lasers on and off at will)

2- In a free space quantum cryptography experiment operating over a distance of 20 km, Alice uses a beam collimator with a diameter of 5 cm to send her photons to Bob. On the assumption that other losses are negligible, compare the fraction of the photons that are incident on Bob's detector when he uses a collection lens with a diameter of (a) 5 and (b) 25 cm.

3- In classical fiber-optic communication systems, the signals are amplified at regular intervals by repeaters to compensate for the decay in intensity due to scattering and absorption losses. Discuss whether it is possible to use repeaters to increase the range of a quantum cryptography system.