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QUANTUM COMMUNICATION TECHNIQUES FOR DEEP SPACE & INTERPLANETARY MISSIONS: EXPLORATION & EXAMINATION OF METHODS MEETING LOW POWER REQUIREMENTS

Abstract

Technical advancements in communication systems design suitable for space conditions have hugely drawn inroads into space mission planning. Especially in deep space or interplanetary missions where the space conditions are extremely volatile and different from near earth missions, the total mission accomplishment is heavily dependent on communication and control systems onboard. The main fundamental principle, on which the communication systems are based, is on the assumption that the receiver is able to retrieve the message what the transmitter is sending. However, for a deep space medium, where the transmitter and receiver are separated by the distance of astronomical units, in order to achieve error free transmission to drive out the ambiguity in the message at the receiver, it would take enormous amount of time to correct the message. This paper tries to explore the difficulties faced by both the classical Quantum communication techniques where the distances are in terms of AUs. The paper explores and explains the possible use of classical communication from earth to outer space, where photon entanglement with the help of satellites are established and further communication is done using quantum communication techniques. This paper will explain in detail the effects of birefringent properties of the atmosphere that increases the probability of error if quantum communication techniques are used thus allowing the only possibility of classical techniques. However, in the outer space due to the limitation of speed using classical communication techniques, quantum communication techniques are favored over classical. Thus this paper will show that probability of error is reduced (minimized) for deep space or interplanetary missions when both the classical quantum communication techniques are used in tandem with each other rather than using them alone.