

47th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) –  
The Next Steps (A4)  
SETI 1: SETI Science and Technology (1)

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A NOVEL APPROACH FOR INTERSTELLAR COMMUNICATION BASED ON MODULATED  
X-RAY BEAMS

**Abstract**

Interstellar communication is a much easier method than interstellar travel to establish contact with extraterrestrial intelligence, due to communication technologies and equipment are currently available. Interstellar communication refers to transmission signals between earth and potentially inhabited planetary system. In order to successfully send interstellar messages, a communication method with less signal attenuation in interstellar channels is needed. X-ray communication (XCOM) has the potential to accomplish a stable and high-speed interstellar communication.

XCOM uses the X-ray beam as the signal carrier to wirelessly transmit data and is considered as the next-generation space communication technology. During interstellar X-ray communications, the transmitter generates an X-ray pulse sequence containing information by modulating the intensity of X-ray beam. Pulsed X-ray beams travel through the interstellar space and are potentially probed by extraterrestrial receivers. By detecting the intensity of X-ray beams, extraterrestrial intelligence can obtain the information contained in the modulated X-ray beams. Compared to RF and optical based communication, interstellar communications based on modulated X-ray beams could provide many advantages. The exceedingly high frequency of X-ray allows XCOM to theoretically provide significantly large communication bandwidths up to 40 Petabits/s. The extremely small diffraction angle allows X-ray beam to demonstrate excellent focusing performance, which could drastically reduce the geometric attenuation of communication links. The small interstellar extinction coefficient of the X-ray band enables the X-ray link to achieve less channel attenuation, which allows X-ray signals to reach farther distances. In addition, XCOM facilities have advantages in size, weight and power consumption compared to radio frequency and laser communication facilities. Therefore, the XCOM system can potentially realize high-speed data transmission between earth and other potentially inhabited systems at low power.

In this study, the simulation of interaction between X-ray and interstellar medium was carried out. The transmission performance of X-ray beams in interstellar medium was evaluated and compared with other communication bands. The result proved that XCOM is an effective approach for reducing signal attenuation caused by the interstellar medium. Changes in the time and intensity characteristics of the

X-ray pulse sequence during the interstellar signal transmission were analyzed, and the communication performance was evaluated. The result provided a preliminary demonstration of the potential application of XCOM for interstellar communication and obtained the optimal X-ray frequency.