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SPACE POWER SYMPOSIUM (C3)
Wireless Power Transmission Technologies, Experiments and Demonstrations (2)

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NEW CONCEPT OF SPACE SOLAR POWER SATELLITE BASED ON DIFFRACTIVE OPTICS AND ULTRA-FAST OPTICS

Abstract

As an efficient way to utilize space solar power, the Space Solar Power Satellite (SSPS) concept has attracted great concerns of international society. As the most important technologies, solar power collection and space wireless energy transmission have been studied for years. For increasing the efficiency continually, it demands advanced technologies. In this presented paper, the new solar power collection system based on diffraction optics has been proposed, which makes a lightweight, deployable and large-aperture system. The experimental results show that the concentration ratio of prototype is about 500, demonstrating a remarkable focusing performance. Our investigation on new concept of wireless energy transmission based on ultra-fast optics has been reported. When the ultra-fast laser propagates in air, the plasma filaments are generated due to the nonlinear physical effect. There are abundant free electrons in the plasma filaments, which makes the filaments own electric capability. Meanwhile, the plasma filaments can propagate a long distance, about 20 km, so the plasma filaments can be used as an artificial electrical wire which could directly transmit the electrical power to the equipment on the earth. This innovative method reduces the energy loss and improves the efficiency of wireless energy transmission. Our experimental result shows that the electrical energy transferred by plasma filaments makes light-emitting device work successfully, which confirms the feasibility of technology and system. According to the research results, we develop the "three-step model". Firstly, the space solar power is collected by the diffractive optical system assembled on SSPS, and transformed into the electrical energy. Secondly, the energy is transferred by the method of microwave or laser from the SSPS to the airship. Thirdly, the electrical energy transfers along the plasma filaments from the airship to the receiving system on the ground.