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DUAL-LAYER PROTECTION SYSTEM FOR SATELLITE DEFENSE AGAINST SOLAR STORMS

Abstract

Satellites operating in Earth's orbit are constantly exposed to various environmental hazards, with solar storms posing significant risks due to their potential to unleash intense bursts of radiation and charged particles. In this study, we propose a comprehensive protection system comprising two key components: an electromagnetic shielding layer and a radiation absorption layer, both of which work to minimize the impact of solar radiation events during solar storms. The first component of our protection system involves the implementation of an electromagnetic shielding layer, which serves to reduce the intensity of solar storm radiation by employing electromagnetic barriers. These barriers effectively block or attenuate electromagnetic waves, thereby limiting their penetration into the satellite's internal systems. By limiting the initial exposure to solar radiation, the electromagnetic shielding layer lays the foundation for enhanced protection against the adverse effects of solar storms. In conjunction with electromagnetic shielding, the second component of our system utilizes a multi-functional layer capable of absorbing, deflecting, and redirecting the remaining solar radiation. This layer is engineered using advanced materials and design principles to maximize its effectiveness. By incorporating features such as radiation-absorbing materials, reflective surfaces, and strategically positioned deflectors, this layer minimizes the transmission of solar radiation through the satellite's structure, thereby reducing the risk of damage to sensitive components. Crucially, our proposed protection system is designed to be proactive and responsive, ensuring functionality upon receiving a warning of an approaching solar storm from ground stations. Leveraging real-time monitoring and communication capabilities, satellites equipped with our shielding technology can promptly activate defensive measures to safeguard onboard systems and ensure operational continuity during solar storm events. In conclusion, the proposed dual-layer protection system represents a significant advancement in satellite defense strategies against solar storms offering a robust and adaptable solution for protecting satellites, paving the way for enhanced reliability and longevity of space-based assets in an increasingly challenging space environment.