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Radiation-induced degradation in optoelectronic devices for satellite applications: a review
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Abstract
Optoelectronic devices play a crucial role in the functionality of satellite systems, particularly in optical communication. However, these devices face significant challenges due to radiation-induced degradation, which can compromise their performance and reliability in the harsh space environment. This review provides a comprehensive analysis of the impacts of various types of radiation, including protons, electrons, gamma, and neutrons, on optoelectronic components used in satellite applications. The review discusses the mechanisms through which radiation interacts with semiconductor materials, leading to phenomena such as ionization and charge build-up, which can result in the deterioration of key performance parameters such as optical efficiency, signal integrity, and operational lifespan. The review delves into the specific effects of radiation on critical optoelectronic components, including photodetectors, light-emitting diodes (LEDs), and laser diodes, with a particular focus on inter-satellite optical wireless communication systems. By analyzing the existing literature, this review traces the evolution of research on radiation effects, highlighting trends in understanding and mitigating radiation-induced damage. It also identifies gaps in current knowledge and suggests areas for future investigation to enhance the resilience of optoelectronic devices against radiation. This effort provides valuable insights that can inform the design and development of more robust optoelectronic systems capable of maintaining reliable operation in radiation-rich environments, thereby contributing to the advancement of satellite communication technologies.

Author Keywords
Degradation; Inter-satellite; Optoelectronics devices; Performance; Radiation; Space

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