Abstract

Single event upsets (SEUs) in computer systems, also known as bitflips, are highly disruptive events that occur when a particle of radiation causes a change in the value of a bit stored in memory. These errors have the potential to cause significant harm, including data loss and system failures, making their prevention and management of critical importance. In this research paper, we employ an interdisciplinary approach to understand the underlying mechanisms of SEUs and explore the various factors that contribute to their occurrence and impact. We begin by providing a historical overview of SEUs and discussing real-world incidents that illustrate their potential consequences. Next, we delve into the physics-related factors that influence SEUs, including the various sources of radiation and the role of Coulomb's Law in their occurrence. We also examine the computer science-related factors that impact the severity of SEUs, including the design of memory cells and the determination of the output (0 or 1) in these cells. To mitigate the risks posed by SEUs, a variety of prevention methods developed have been discussed, including shielding, modular redundancy, error correction codes (ECCs), and scrubbing. In our evaluation of these methods, we consider their effectiveness in preventing SEUs and identify areas for future research. This research paper aims to provide a comprehensive understanding of SEUs and their potential impacts on computer systems, highlighting the importance of preventative measures and the need for continued research in this area.