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APPLICATION OF SILICON PHOTOMULTIPLIER SENSORS IN SPACE MISSION

Abstract

A silicon photomultiplier (SiPM) is a matrix of tiny avalanche photodiodes operating in the Geiger mode. High electric field formed by the reverse bias above the breakdown voltage over the PN junctions creates avalanche process of high multiplication in a diode from an ionization induced by incoming photon. Reading out the signals from all the diodes into an output, the sensor provides the capability of fast photon counting. The performance of the sensors is insensitive to magnetic field and mechanical impact or vibration. Compared to conventional photomultiplier tube (MAPMT), it consumes lower power, occupied much smaller space and weight, and does not require high operation voltage. Since this type of photon sensors was developed by Russian Group in 1998 and 2000, many applications have been made in various radiation fields including nuclear and particle experiments and medical instrumentation. Especially all the features of the sensors make the sensor a very promising photon detector for space application. We have developed arrays of SiPM sensors for the use in the future space telescope. The sensors were fabricated in arrays of 4*4 channels, each consisting of 32*32 photodiodes with a size of 30*30 mm2. We discuss the performance of the sensor and the design of focal detector using the sensor for future space mission.