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Effect of charge transfer mechanisms on the charge transfer inefficiency of charge-coupled devices used as particle detectors

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Radiations have effect on charge-coupled devices used as particle detectors. Many electrical characteristics in these devices are affected such as dark current and charge transfer inefficiency (CTI). In this work we will study the effect of traps, created after irradiating CCD, on the CTI. In previous works [1-2], we have used simple analytic models by including some timing parameters. To add more interesting parameters, the analytic modeling becomes difficult or impossible, hence the need of numerical modeling.

A simple numeric model is used to study the effect of traps on the CTI with taking into account the effect of charge transfer mechanisms (self-induced drift, fringing-field drift and thermal-diffusion) in contrast to the analytical modeling where we have neglected them. This study allows the determination of the frequency limit where the charge signal is not well transferred even with the presence of low density of traps. The CTI as a function of temperature is also presented.

References

- [1] A. Sopczak et al., "Simulations of the Temperature Dependence of the Charge Transfer Inefficiency in a High-Speed CCD", IEEE Trans. Nucl. Sci., vol. 54, no. 4, pp. 1429–1434, 2007.
- [2] A. Sopczak et al., "Modeling of Charge Transfer Inefficiency in a CCD With High-Speed Column Parallel Readout", IEEE Trans. Nucl. Sci., vol. 56, no. 3, pp. 1613–1617, 2009.

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