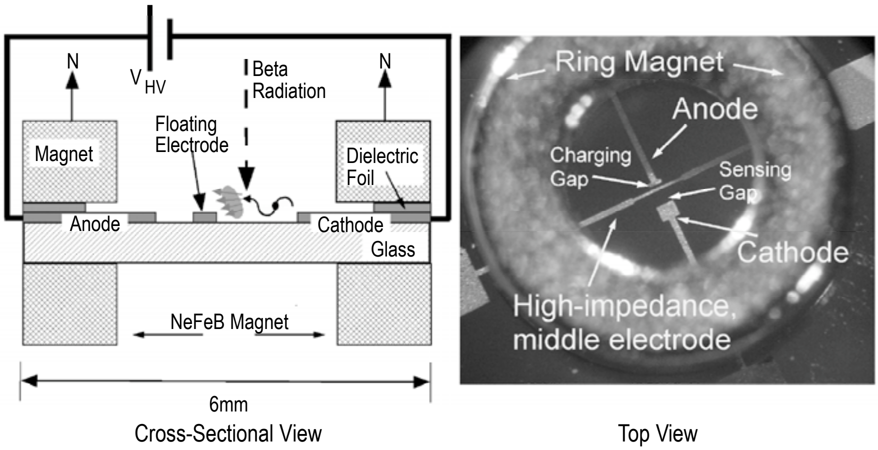
A Wireless Micromachined Radiation Sensor

Christine K. Eun and Yogesh B. Gianchandani



Left – Cross-section of the micro-Geiger counter on a 6mm² x 6mm² glass chip in a ring magnet configuration, Right – Photograph of top view showing high-impedance middle electrode. Magnets were positioned to enhance the wireless signal emitted during operation.

Networked radiation sensors are envisioned for monitoring public spaces with high-pedestrian traffic such as train stations, football stadiums, and shopping malls. Wireless communication between sensors can enable rapid and low-cost deployment and reconfiguration of such networks. By employing a discharge-based transmission method, this project aims to enhance a micromachined Geiger counter with wireless communication capability. The device consists of a planar, 3-electrode, metal-on-glass design utilizing a high-impedance middle-electrode sandwiched between two permanent magnets. This 3-electrode approach enables greater control of discharge energy, resulting in faster response time, wider dynamic range, lower power consumption, and superior durability. The 3-electrode design widens the available operating range and achieves 10x–100x improvement in detector sensitivity. Wireless measurements showed an inherent sensor transmission bandwidth exceeding 3GHz, while detecting ultra-low-level (0.1μCi–1.0μCi) β-sources. Improved transmitter performance is achieved with the employment of miniaturized permanent magnets, which increases ionization efficiency and increases the transmission bandwidth by more than 2x. This project is supported by the Engineering Research Centers Program of the National Science Foundation under Award Number EEC-9986866.