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Advances in Nuclear Monitoring Technologies

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Homeland security requires low-cost, large-area detectors for locating and identifying weapons-usable nuclear materials and monitors for radiological isotopes that are more robust than current systems. Recent advances in electronics materials and nanotechnology, specifically organic semiconductors and inorganic quantum dots, offer potential improvements. We provide an overview of the physical processes involved in radiation detection using these new materials in the design of new device structures. Examples include recent efforts on quantum dots, as well as more traditional radiation-detecting materials such as CdZnTe and high-pressure xenon. Detector improvements demand not only new materials but also enhanced data-analysis tools that reduce false alarms and thus increase the quality of decisions. Additional computing power on hand-held platforms should enable the application of advanced algorithms to radiation-detection problems in the field, reducing the need to transmit data and thus delay analysis.