Gamma Ray Color Camera Based on Liquid Xenon

OCR Number: OCR 5186

Description:

Given the threats posed today by nuclear proliferation and terrorism, there exists a need for sensitive instruments with the ability to not only detect and identify nuclear material, but also to image the source of gamma radiation. An imaging capability greatly enhances the localization of the source after initial detection. Furthermore, because natural radioactive backgrounds can vary substantially with time and location, an imaging capability is valuable in distinguishing background radioactivity from a concentrated source.

Yale University researchers, leveraging their expertise in building detectors for astrophysics and elementary particle applications, have developed a gamma ray color camera (GRCC) using liquid xenon (LXe) as the active material. Because LXe is a high density material (3.0 g/cc) with large atomic number, it is highly efficient for scattering and capturing gamma rays. Its high gamma stopping power (6 cm attenuation length for 1 MeV gamma rays) enables remarkably compact devices. Novel design features of the GRCC allow the flashes of scintillation light to be separately assigned to individual gamma ray interactions and makes excellent energy resolution and angular resolution possible.

Advantages:

- Excellent energy resolution
- Imaging capability with projected angular resolution of ~1 degree at 1 MeV
- Low cost of LXe in comparison to solid state imagers
- Operating temperature of 165K
- Compact size scaleable to larger detector areas

Field of Application: This technology is appropriate for any field requiring the detection, identification and/or imaging of radiation. These include homeland security (imaging vehicles and cargo containers), military (searching for loose radioactive material), nuclear power, environmental and medical applications (positron emission tomography).

Stage of Development: Prototype device under construction.

IP Status: United States provisional patent application pending.

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