DYNAMIC ENHANCEMENT OF RADIOLUMINESCENCE IN SOLAR BLIND SPECTRAL REGION

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Alpha emitting radiation sources are typically hard to detect due to the short range of alpha particles in air (4cm). A remote detection of alpha radiation in air is possible by imaging the ionization-induced fluorescence (radioluminescence) of air molecules [1]. The alpha-induced ultraviolet light is mainly emitted by molecular nitrogen as fluorescent light with wavelengths in the regime of 297-405 nm. The main benefit of this method is the long range of UV-photons in air, which allows for remote detection of alpha emitting radiation sources. However, in many applications background lighting caused by sunlight with a spectrum reaching down to ~300 nm makes the fluorescence signal difficult to isolate [2]. Under environmental conditions radioluminescence in wavelength regimes <300 nm (the solar blind spectral region) by molecules other than N_2 is not detectable.

In this work, we demonstrate that the radioluminescence spectrum of an alpha emitting radiation source can be modified by flushing the volume surrounding the source with N_2. Fig. 1 shows the rise of nitric oxide (NO) luminescence in the wavelength regime <300 nm. Radioluminescence signals like these are potentially useful in radioactive threat detection under conditions where daylight exposure cannot be avoided. Our approach offers a possible way of detecting hazardous radioactive sources from a distance that greatly surpasses the range of the alpha particles themselves and has the potential to be developed into a viable tool for radioactive threat detection in a field environment.

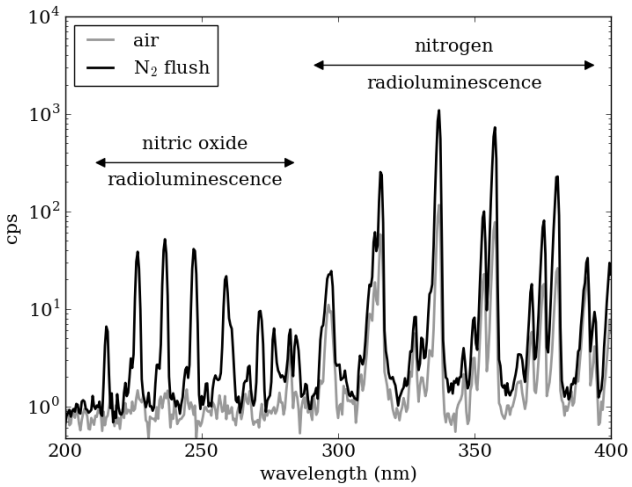

Fig. 1 The intensity of nitric oxide (NO) radioluminescence is strongly dependent on the atmosphere around the emitter. Increasing the concentration of N_2 allows the light yield of NO fluorescence to reach detectable values.

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