RADIOLUMINESCENCE OF ALPHA-PARTICLE EXCITED GASES IN DEEP ULTRAVIOLET REGIME

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Alpha emitting radiation sources are hard to detect due to the short range of alpha particles in air. A remote detection of alpha radiation in air is possible by measuring ionization-induced luminescence of air molecules [1]. Alpha-induced ultraviolet (UV) light is mainly emitted by molecular nitrogen (N_2) and its luminescence properties are well known. The benefit of this method comes with the long range of UV-photons in air. However, alpha-induced luminescence of N_2 is typically weak compared to the solar background lighting, which makes special discrimination methods necessary [2].

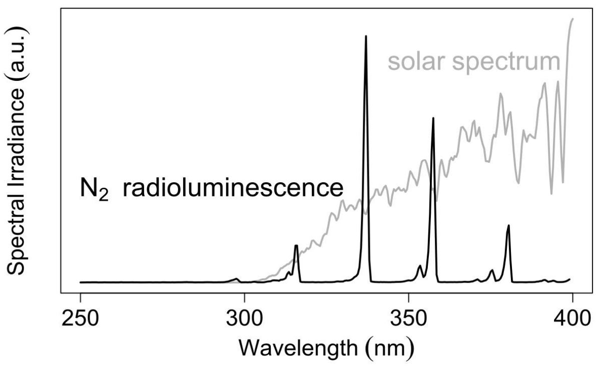

Fig. 1: Spectra of molecular nitrogen radioluminescence and background lighting overlap in UV regime. The spectra are not to scale – in most cases the radioluminescence is orders of magnitudes weaker than the solar spectrum.

To develop applications for daylight conditions, the weak but detectable alpha-induced radioluminescence signal in the solarblind region (Lambda<300nm) has been studied. In order to achieve maximal signal intensity the radioluminescence is studied in various gas mixtures of N_2, O_2 and Ar.

Finally, applicability of the method under normal daylight conditions is discussed. Enhancement of the solarblind transitions by active probing using pulsed laser excitation can help to circumvent the problem of the background lighting.

[1] F. Lamadie et al. , IEEE Transactions on Nuclear Science **52**, 3035-3039 (2005).
[2] J. Sand, S. Ihantola, K. Peräjärvi, H. Toivonen and J. Toivonen, Radioluminescence yield of alpha particles in air, New Journal of Physics **16**, 053022 (2014)