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Detection of stratospheric X-rays with a novel microscintillator sensor

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A new energetic particle detector based on a 1 cm³ CsI(Tl) scintillator crystal responds to both particle count and energy. This offers increased measurement capability over the long-established Geiger counter technology for investigating the role of energetic particles in the atmosphere during meteorological radiosonde flights. Here we present results from three flights over the UK in 2017-18 where the detector was flown alongside Geiger counters to test its capability for measuring ionising radiation in the atmosphere. Operation of the microscintillator detector was verified by both it and the Geiger counters showing the anticipated Regener-Pfotzer maximum at around 17km. Unexpectedly however, two of the flights also detected lower energy signals at 10-100 keV. Laboratory experiments investigating the thermal response of the microscintillator, in combination with careful error analysis, can be used to show that the signals detected do not originate from instrument artefacts, and are statistically significant. These are most likely to be stratospheric X rays, usually associated with bremsstrahlung radiation generated by precipitating electrons from the radiation belts.