Measuring X-rays created by lightning strikes on an aircraft in-flight

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Scientists have recorded measurements of X-rays of energies up to 10 MeV caused by electrons accelerated in the intense electric fields inside a thundercloud.

The researchers, based at the Eindhoven University of Technology, The Netherlands, the National Aerospace Laboratory (NLR), The Netherlands, and Airbus France, report their findings today, Wednesday 30th September, in the *Journal of Physics D: Applied Physics*.

The researchers were able to mount equipment on an Airbus during test flights that took place in April 2014. These flights allowed an opportunity to further test the In-flight Lightning Strike Damage Assessment System (ILDAS) to which the researchers had previously contributed, in addition to mounting X-ray detectors within the cabin.

The study reports on the findings of four lightning strikes on the aircraft, three initiated by the aircraft and one 'aircraft intercepted' strike.

"These four lightning strikes represent all of the effects we were looking at, so they provided us with excellent data." Says Pavlo Kochkin, the first author on the paper.

The results show that most of the X-rays are synchronous with the initiating negative flow of charge within the cloud, as the moving electrons create X-rays via bremsstrahlung in bursts immediately preceding a current pulse of the lightning strike.

The researchers estimate the highest radiation dose in their detector from one of these X-ray bursts to be in the order of 5 x 10-12 Gy. For comparison, the dose normally received due to long flights at altitude is approximately 8 million times higher.

Some of the detected X-ray signals may also be associated with terrestrial gamma-ray flashes (TGF). Earth-bound TGF have previously been detected from space, but the relevance of these data to TGF requires further investigation.

"We were extremely lucky to be able to work with our collaborators and Airbus," explains Alex van Deursen, another author on the paper. "This data is very interesting – we've made other lightning physicists quite jealous by getting it first!"

The researchers hope to continue to look for indications of terrestrial gamma-ray flow in the next batch of data from more recent flights.

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