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# Citizen science approach for Galactic Cosmic Radiation and SEP monitoring at commercial flight altitude

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# COSMIC ON AIR : Citizen science approach for Galactic Cosmic Radiation and SEP monitoring at commercial flight altitude

The solar flare hunt is on!

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## Scientific context

Intense solar energy proton events with an effect in the atmosphere are sporadic and rare but can generate a high dose rate at flight altitude. Very few such events have been measured, making it impossible to validate the dose estimation model. This project aims to provide measured data to the scientific community through a citizen science approach.

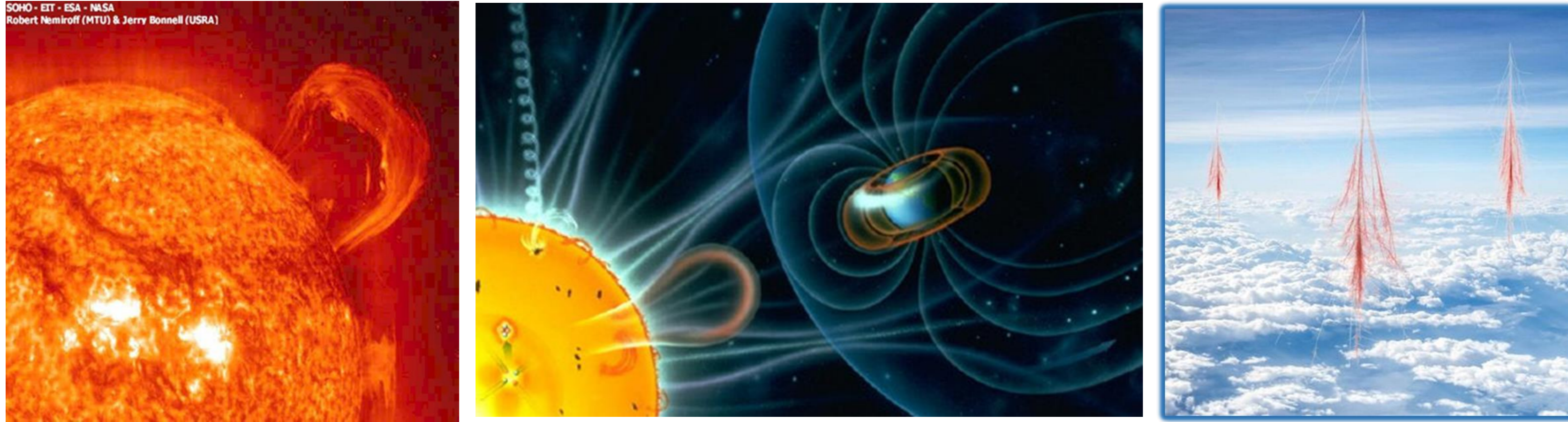


Figure 1. Solar flares.

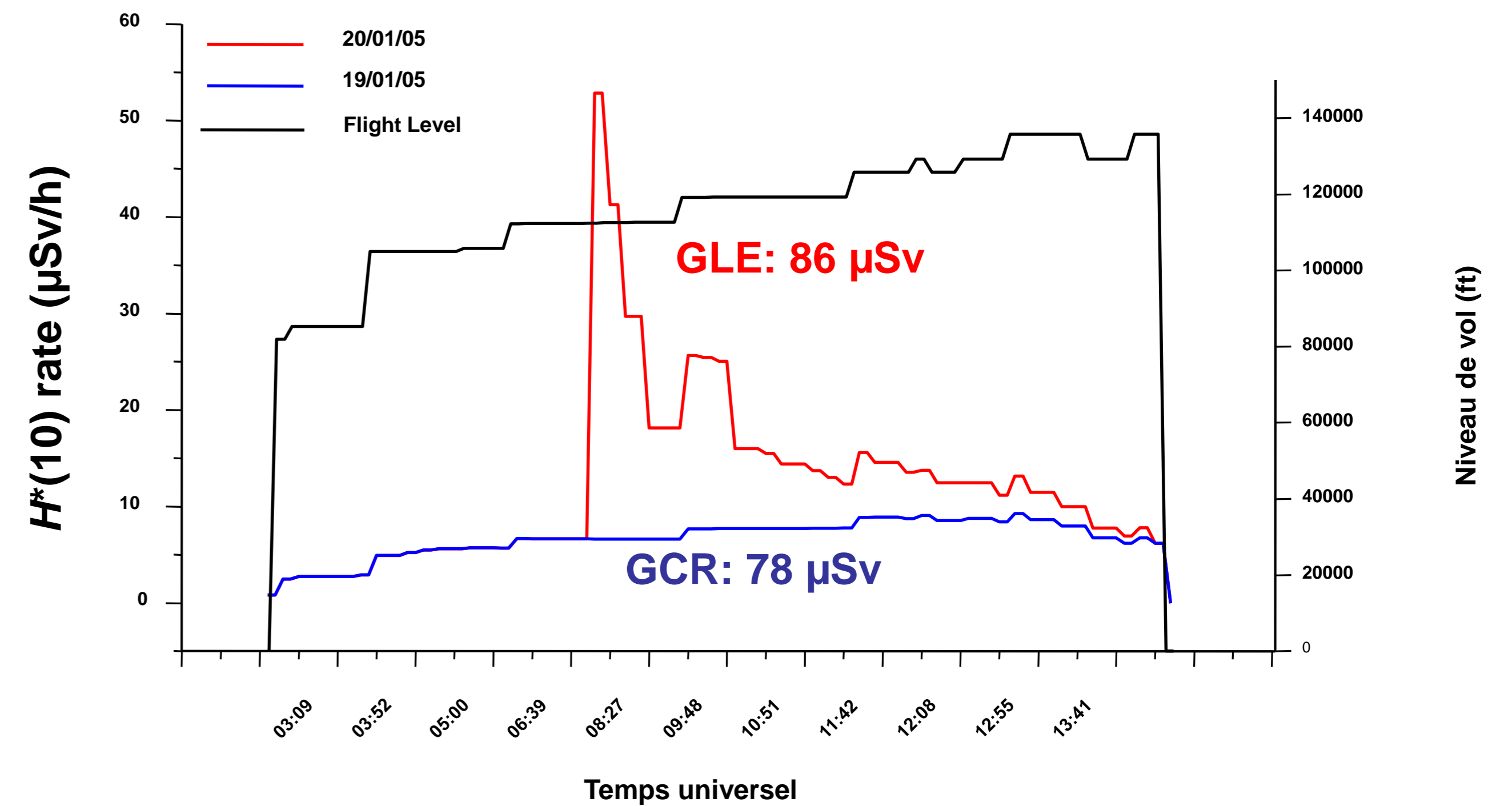
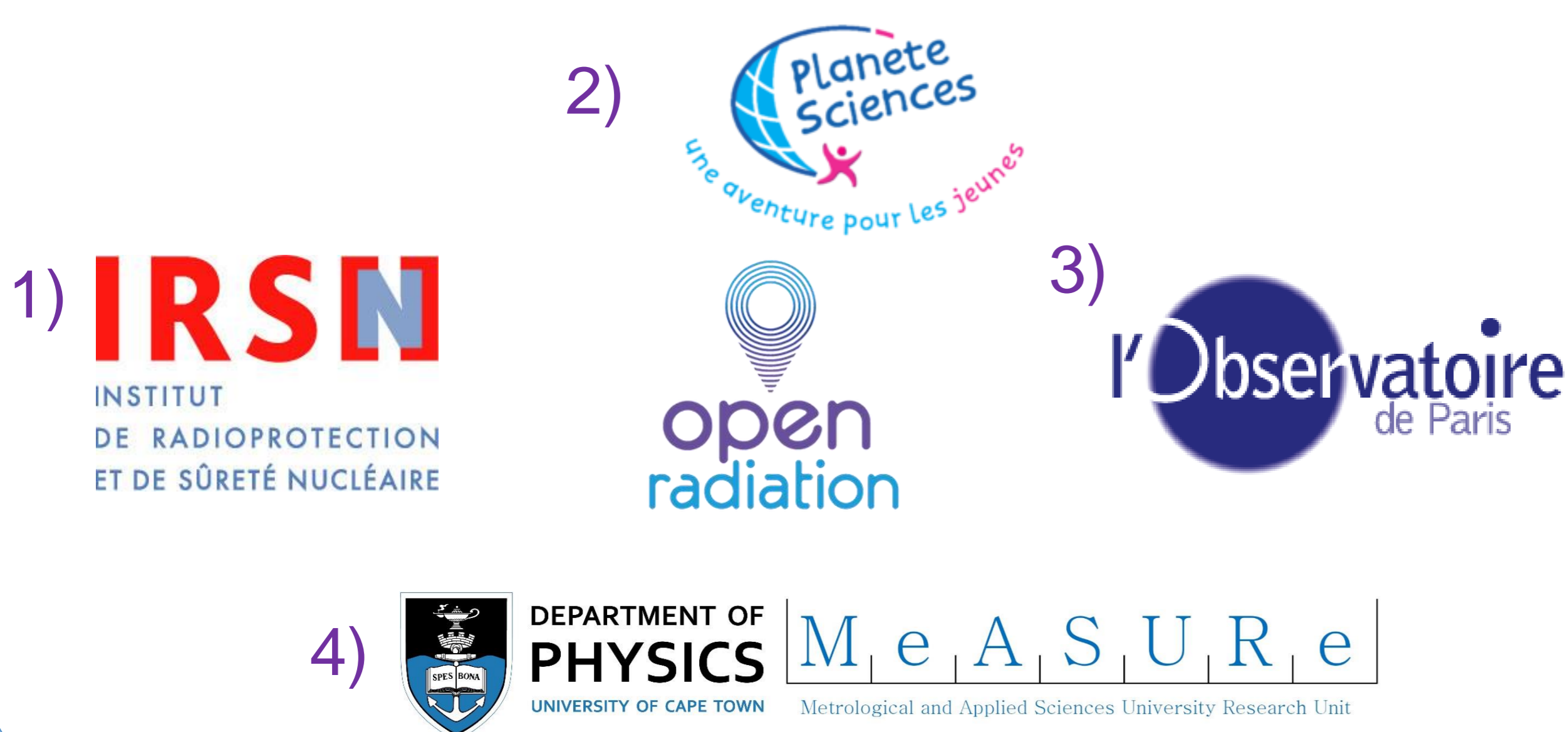


Figure 2. Measured dose rate due to the galactic component of cosmic rays compared with additional contribution from SEP: the dose is doubled on the same flight.

## Project partners



## How to participate?

Contact via OpenRadiation website or cosmic@irsn.fr to participate in:

- Detector development or characterization;
- Improving website and apps;
- Data analysis and measuring; and
- Proposing new actions (balloon flights,...).



Figure 3. Measurement campaigns with balloon flights (credit Planète sciences).

## Data collected and calibration aspects

- Data are collected through the Openradiation website and apps or any other detectors with a data logger (Safecast, GQ family).
- A dedicated mode of measurements in airplanes is now available in the OR app.
- Specific calibration coefficients for CR have been derived from in-flight measurements by comparison with reference detectors (Hawk TEPC) or with calculation (CARI-7).

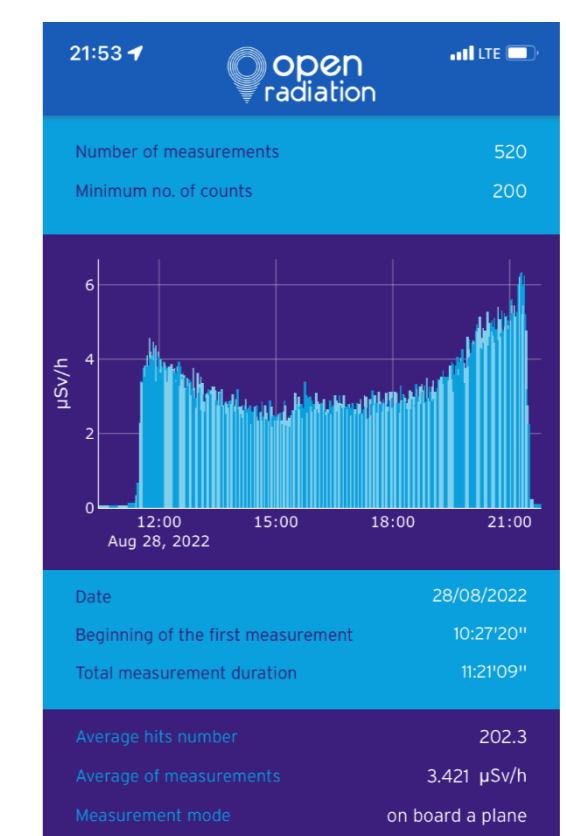
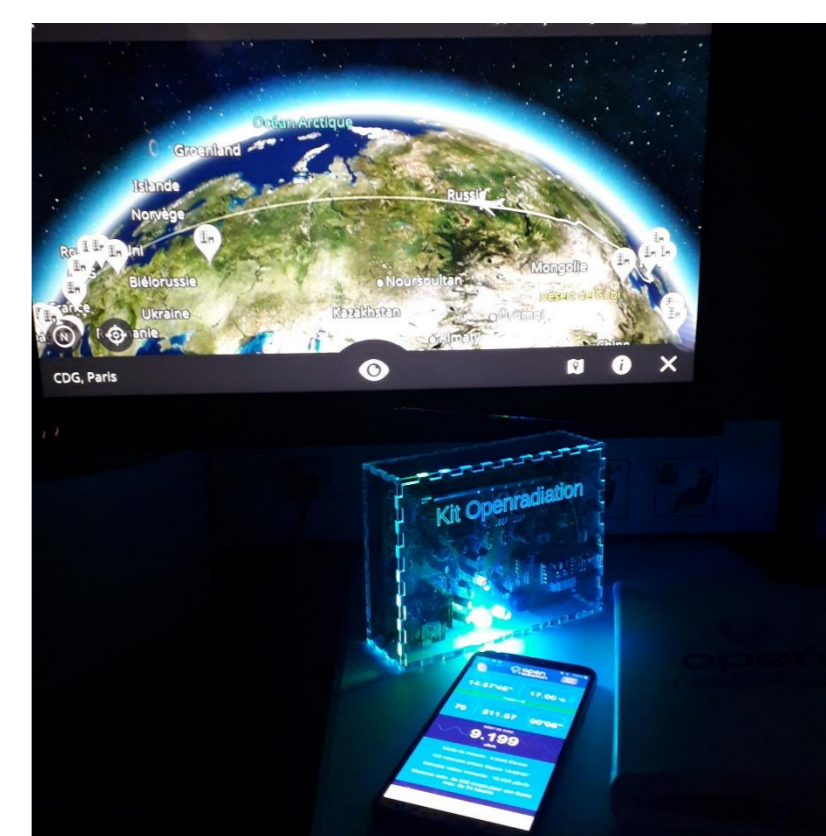
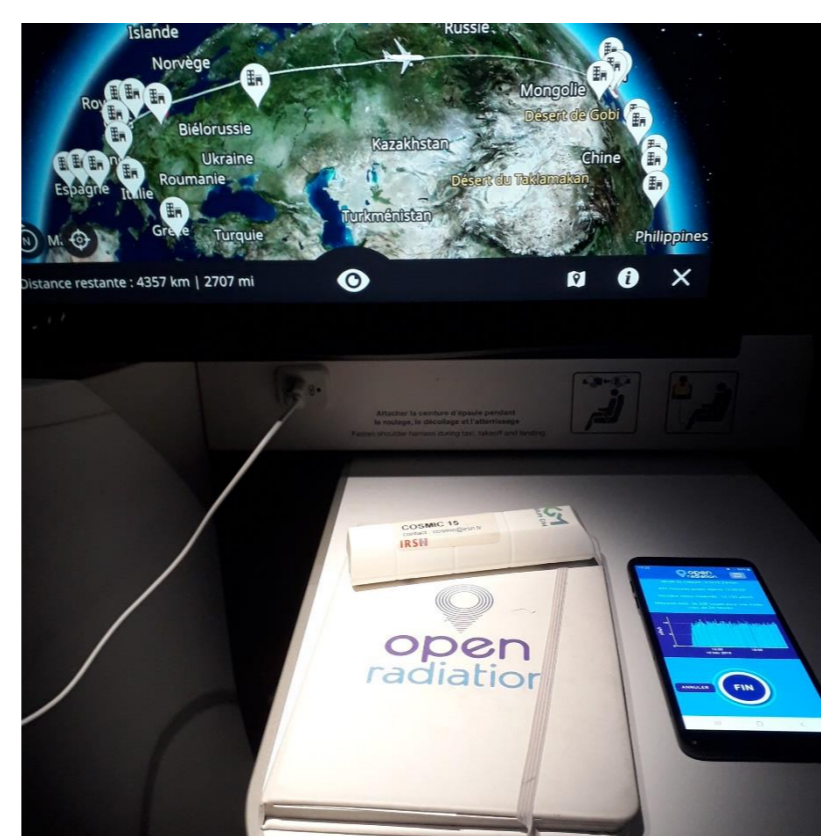
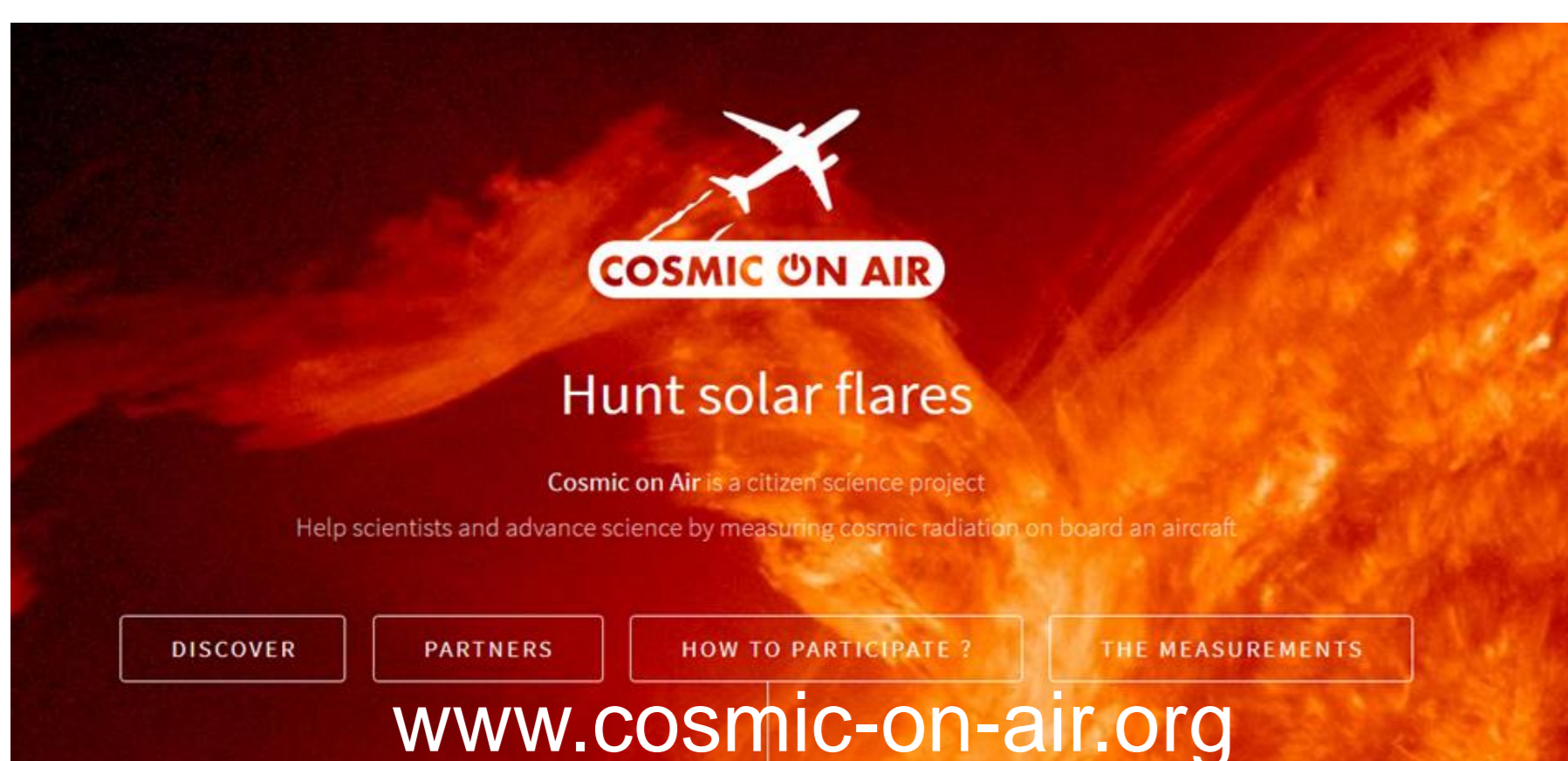


Figure 4. In-flight measurements with OR app.

Figure 5. IRSN Hawk TEPC.



- 225 flights measured, 57195 measurements.
- All measurements were made under normal space weather conditions, but the solar maximum is expected to be reached in 2025, with an increased probability of intense solar flares.



Figure 6. Overview of data collected since 2019.

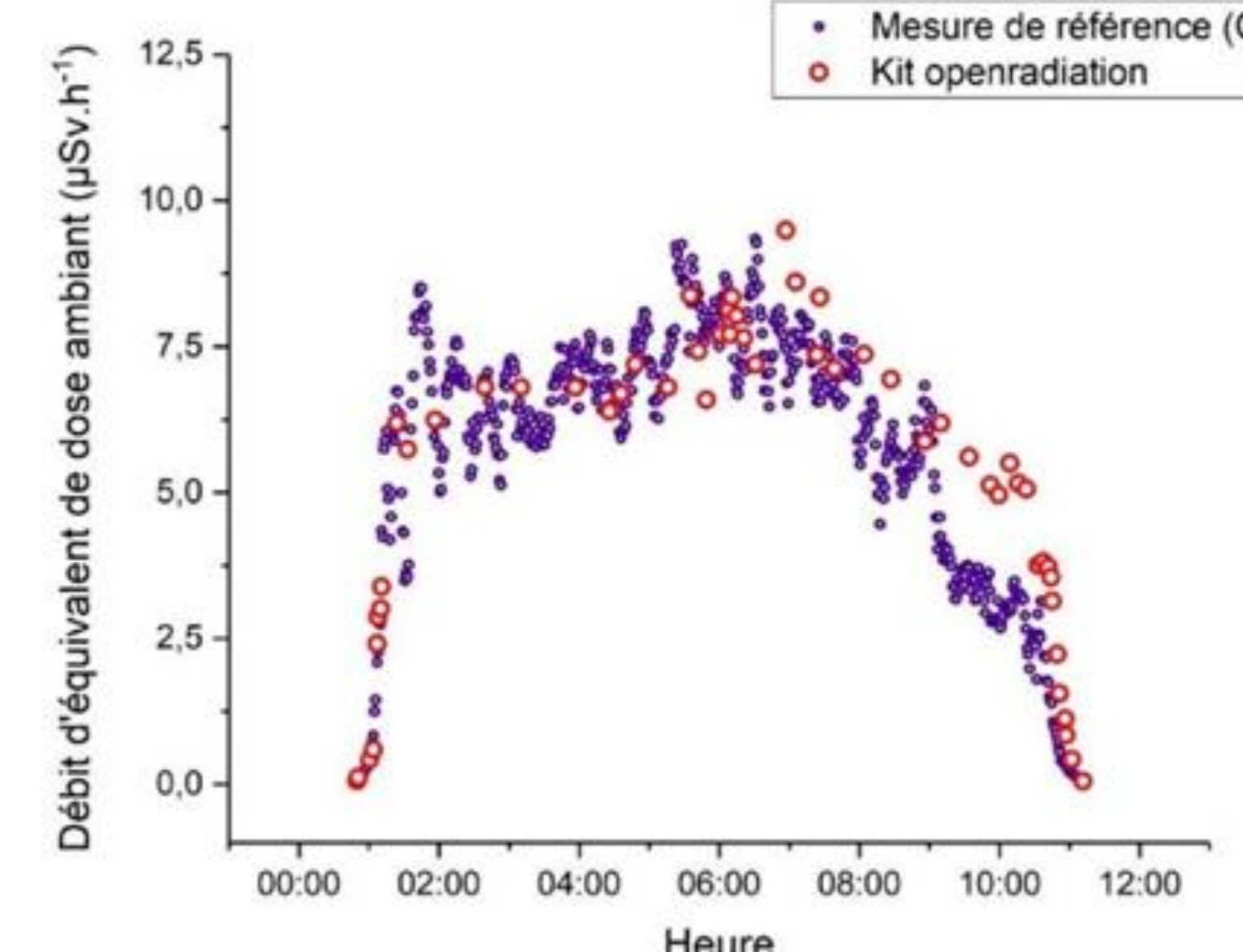
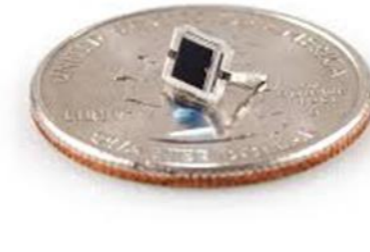


Figure 7. Comparison between reference measurement with TEPC and OR kit detectors.

## Devices characterized

- ✓ Devices can be connected by BT to the OpenRadiation app (openradiation kit, Safecast, Rium GM, Atomtag, Pocketgeiger, Polimaster).
- ✓ Detection principles: GM tube or photodiode.



## Alternative approaches

Due to the cost of the devices, evaluations with webcams or CMOS from smartphone cameras are being studied to democratise the measurement, or with scintillators for the measurement of secondary neutrons.

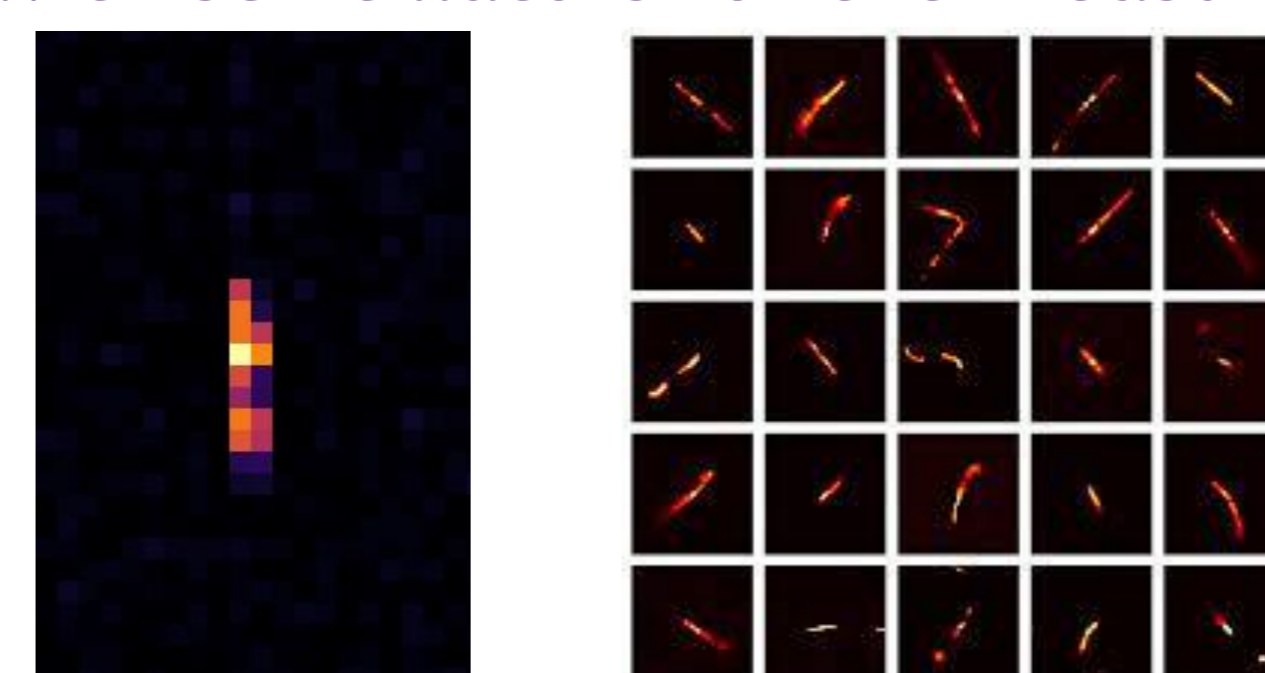


Figure 8. Screenshots of CR detection in CMOS sensor of smartphone camera.



Figure 9. Prototype of the compact neutron detector based on scintillator from MeASURE.