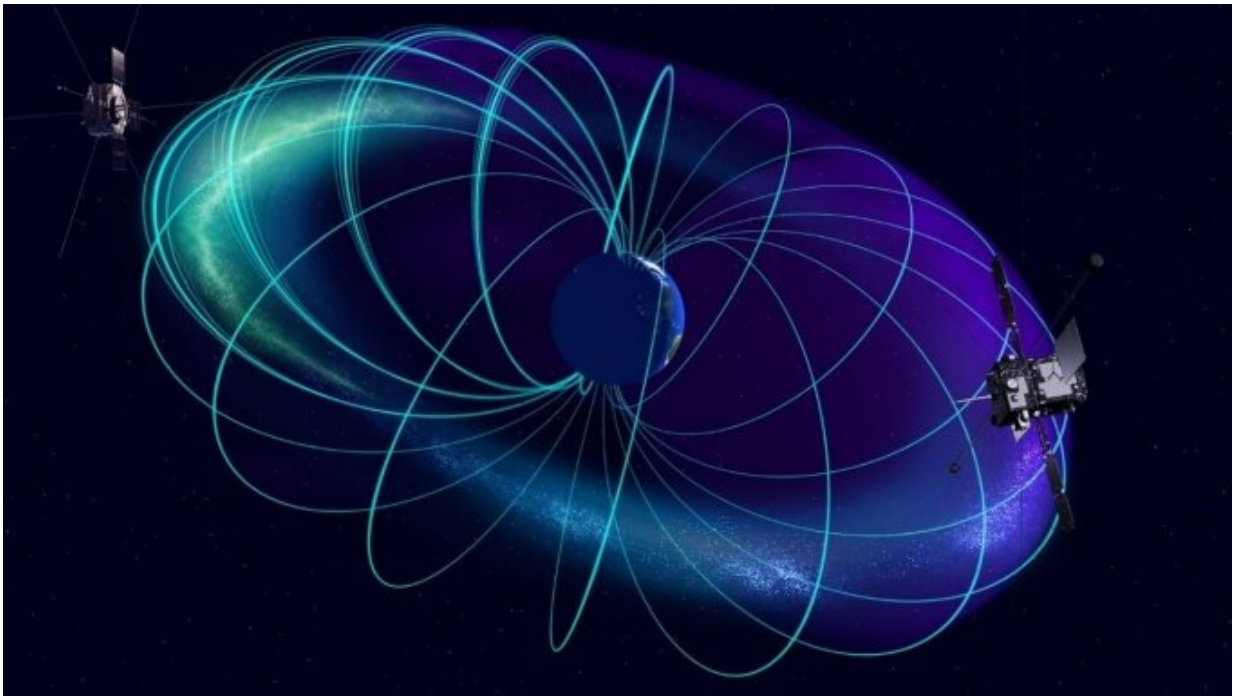


Finding a killer electron hot spot in Earth's Van Allen radiation belts

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Multi-point satellite observations by JAXA/Arase and NASA/Van Allen Probes. Electrons detected at Van Allen Probes position (left) drift to the Arase position (right). Credit: ERG Science Team

A collaboration between researchers in Japan, the U.S., and Russia has found a hot spot in Earth's radiation belt where killer electrons, which can cause serious anomalies in satellites, form. The finding, published in the journal *Geophysical Research Letters*, could help scientists more

accurately forecast when these killer (relativistic) electrons will form.

Professor Yoshizumi Miyoshi of the Institute for Space-Earth Environmental Research at Nagoya University and colleagues compared data from two satellites situated on opposite sides of the Earth: the Arase satellite, developed by the Japanese Aerospace Exploration Agency (JAXA), and NASA's Van Allen Probes. Both satellites gather data from the Van Allen radiation belts, zones of energetic particles originating largely from solar wind. Energetic particles in the belts are trapped by Earth's magnetic field.

Scientists have known that electrons in Van Allen radiation belts that interact with ultralow frequency plasma waves accelerate to reach the speed of light. However, it has not been clear when or where these [killer electrons](#) start to accelerate.

To gain more insight about the electrons, Professor Miyoshi and his colleagues analyzed data generated on March 30, 2017, by the Arase satellite and Van Allen Probe. On one side of the Earth, the Van Allen Probe identified characteristic signs of an interaction between ultralow frequency waves and energetic electrons. On the opposite side, at the same point in time, the Arase [satellite](#) identified high-energy electron signatures, but no ultralow frequency waves.

The measurements indicate that the interaction region between electrons and waves is limited, but that the killer electrons then continue to travel on an eastward path around the Earth's magnetosphere.

"An important topic in space weather science is understanding the dynamics of killer electrons in the Van Allen radiation belt," says Miyoshi. "The results of this study will improve the modelling and lead to more accurate forecasting of killer electrons in Van Allen [radiation belts](#)."

More information: M. Teramoto et al. Remote Detection of Drift Resonance Between Energetic Electrons and Ultralow Frequency Waves: Multisatellite Coordinated Observation by Arase and Van Allen Probes, *Geophysical Research Letters* (2019). [DOI: 10.1029/2019GL084379](https://doi.org/10.1029/2019GL084379)

Provided by Nagoya University

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