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Earth's Magnetic Field Hisses Due to Distant "Chorus"

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for National Geographic News

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Thousands of miles above Earth, a cosmic chorus is filling the heavens with a mysterious, low frequency "hiss."

That's the conclusion of scientists studying data from a set of NASA probes designed to monitor substorms—dramatic exchanges of energy among charged particles that spark the auroras at Earth's poles.

The charged particles come from the sun and get trapped in loops around our planet by Earth's magnetic field.

Knowing how the hiss influences the loops, known as Van Allen radiation belts, might help scientists predict their behavior—a good thing, because the belts can bombard satellites, spacecraft, and even spacewalking astronauts with dangerous radiation.

Although we're currently experiencing an unprecedented lull in solar activity, space is expected to get much stormier after 2012, when the sun should enter an active phase that will hurl more charged particles toward Earth.

Lucky Break

The faint "shh" sound that scientists now call the plasmaspheric hiss is the result of an electromagnetic wave in Earth's radiation belts.

The hiss wave appears to reduce levels of dangerous electrons in the radiation belts by deflecting the particles from their stable trajectories and sending them into the dense upper atmosphere, where they are lost.

For more than four decades scientists have been puzzled by what was generating the hiss wave, noted study leader Jacob Bortnik, of the University of California, Los Angeles.

A previous model had suggested that the hiss wave might evolve from a more distant radio wave called chorus, so named because its discoverers in the 1950s thought it sounded like "a rookery of birds heard from a distance," Bortnik said.

But proving this idea presented a challenge. Researchers would need simultaneous, high-resolution observations from two sophisticated satellites recording both hiss and chorus from different locations at a moment when Earth's magnetic field was particularly active.

By chance, one of Bortnik's students found exactly what they needed in data from two of NASA's five THEMIS satellites.

"We didn't think that we'd be lucky enough to get this kind of gift from nature," Bortnik said.

The probes showed a definite correlation between the two waves, confirming that the hiss wave comes from chorus.

Weather Forecasts

Understanding the hiss wave's origins could allow scientists to build more accurate models of the radiation belts, which could ultimately help predict space weather.

Studying space weather, Bortnik added, is similar to studying weather patterns here on Earth.

"Step number one is just to understand the system," he said, and then maybe there's hope that researchers can predict things in time to avoid danger.

Findings published this week in the journal Science.
