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## Satellite swarm to study aurora's triggers 📡

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- NewScientist.com news service
- David Shiga

A fleet of satellites called THEMIS will launch in February to determine what triggers magnetic 'substorms' on Earth that cause auroras and may unleash radiation that can endanger astronauts and fry satellites.

Substorms are periods of rapid change in the region around the Earth dominated by the planet's magnetic field, called the magnetosphere. They are associated with the sudden brightening of light displays in the sky called auroras.

Isolated substorms can happen during periods of relatively little solar activity, and are not dangerous. But when the Sun has an outburst that sends clouds of charged particles streaming towards Earth, a series of 10 or more substorms can occur in rapid succession. This barrage may be responsible for the failure of power grids and satellites observed during some of the events.

There are two competing ideas for what triggers substorms. One says they happen when solar activity compresses the magnetic field lines around Earth, causing large electrical currents to flow in the tenuous gas of charged particles in the magnetosphere.

The other hypothesis is that substorms happen when magnetic field lines compress and suddenly relax in events called magnetic reconnections, which accelerate charged particles towards the Earth.

### Spare satellite

Understanding what triggers substorms could help scientists predict which solar outbursts are hazardous and which will leave the Earth and its vicinity relatively unscathed.

To identify their trigger, NASA is launching a fleet of five satellites called Time History of Events and Macroscale Interactions during Substorms (THEMIS). The satellites will launch together on a single Delta II rocket on 15 February from NASA's Kennedy Space Center in Florida, US.

Two of the probes will orbit the Earth at one-sixth of the distance to the Moon while the other two will orbit about midway between the Earth and the Moon. The fifth one is a spare that can be used to replace any of the four others.

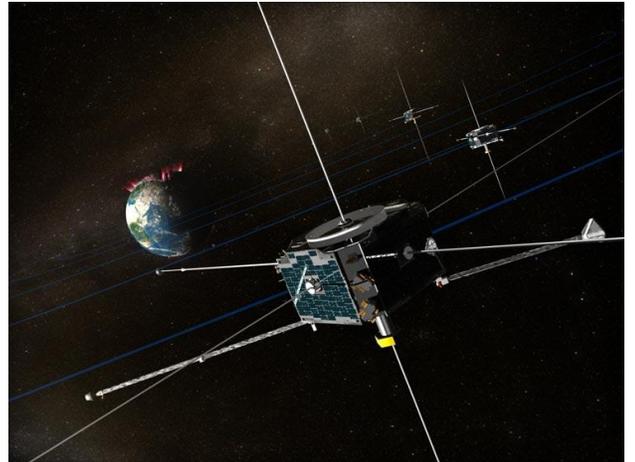
Watch an [animation](#) showing the launch and deployment of the THEMIS satellites.

### Cause and effect

THEMIS is a stepping stone towards understanding space weather and its effects, says the mission's chief scientist, Vassilis Angelopoulos of the University of California, Berkeley, US.

"Unless we understand how space storms work, it is very difficult to predict when they are going to happen," he says. "It is even more difficult for us to predict what the effects are going to be."

THEMIS will improve the understanding of space weather by determining which of the two candidate processes triggers substorms, he says. "By timing the onset time of the current disruption process and the reconnection process we can tell



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The five THEMIS satellites will orbit the Earth to improve our understanding of space weather (Illustration: NASA)

which one starts first," he says, revealing which is the cause and which is the effect.

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