THE GRAND CHALLENGE INITIATIVE-CUSP

9 MISSIONS • 12 ROCKETS

MAGNETOSPHERE

POLAR CUSP

AZURE*
Auroral Zone Upwelling Rocket Experiment

How do auroras impact the total amount of energy gained or lost by the atmosphere? AZURE measures ionospheric winds and circulation to better understand auroral effects.

ICI-5
Investigation of Cusp Irregularities-5

Turbulent hot patches of dense plasma exist inside the auroral region. ICI-5 seeks to understand the physical drivers of plasma turbulence, determine the size of the eddy structures, and explore how these plasma structures disturb radio signals.

VISIONS-2*
Visualizing Ion Outflow via Neutral Atom Sensing-2

How do ions get 'boiled' off the atmosphere? VISIONS-2 observes how ionized oxygen—a comparatively heavy element—acquires enough energy to escape our atmosphere. The mission tracks the escape by visualizing the otherwise invisible atoms as they flow outwards.

G-CHASER
G-CHASER

G-CHASER is a collaboration between eight different student-led missions. It provides a unique opportunity for students to design, test, and ultimately fly their experiment from start to finish.

TRICE-2*
Twin Rockets to Investigate Cusp Electrodynamics

Researchers have observed step-like changes in ion energies near the pole. TRICE-2 distinguishes between two potential explanations: magnetic reconnection that turns on and off, like a light-switch, or steady magnetic reconnection occurring in varying locations.

C-REX-2
Cusp-Region Experiment

C-REX-2 measures winds and ion velocity at around 400 km in altitude in the cusp to track causes of increased density there. The mission differentiates between possible causes such as changes in wind, temperature, or ion velocity.

CHI
Cusp Heating Investigation

CHI will measure the flow of plasmas and neutral gases in the cusp, testing current models of how they interact with one another and become heated and accelerated in the process.

JAXA SS-520-3
SS-520-3

Atmospheric escape is a universal phenomenon occurring on Earth, Mars and other planets—but the mechanisms vary case by case. The SS-520-3 mission investigates the wave-particle interactions high in Earth's atmosphere that allow particles to heat up and escape.

CAPER-2
Cusp Alfven and Plasma Electrodynamics Rocket

Auroras are created when fast-moving particles from the sun crash into Earth's atmosphere. CAPER-2 investigates how such particles can be accelerated via Alfvén waves—oscillating, low-frequency waves that provide particles with extra energy and send them speeding toward Earth.

POLAR CUSP

MAGNETOSPHERE

*TWO ROCKETS

THE SCIENCE OF THE CUSP:

The Grand Challenge Initiative - Cusp is an international collaboration to explore the polar cusp—where Earth's magnetic field lines bend down to meet the poles and particles from space can enter our atmosphere.

For more information, please visit: http://www.grandchallenge.no

NASA GSFC/WFF • Andøya Space Center • University of Oslo • JAXA • ISAS • Dartmouth College • University of Iowa • University of Alaska Fairbanks • Clemson University • University of Colorado

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