Earth's ambipolar electrostatic field and its role in ion escape to space

The Endurance rocket team has made a groundbreaking discovery by successfully detecting Earth's ambipolar electric field for the first time. This weak, planet-wide electric field is as important as Earth's gravity and magnetic fields.

This field, first theorized over 60 years ago, is crucial in driving the "polar wind" - a constant outflow of charged particles into space above the Earth's poles.

The electric field in our upper atmosphere plays a vital role in lifting charged particles to heights beyond their natural limits. This could have significant effects on the evolution of our planet, effects that have yet to be fully understood.

The ambipolar electric field, alongside gravity and magnetism, is a fundamental energy field of our planet. It played a crucial role in shaping the evolution of our atmosphere in ways that we are only beginning to explore. "Any planet with an atmosphere should have an ambipolar field," Collinson said. "Now that we've finally measured it, we can begin learning how it's shaped our planet and others overtime."

Electric fields are expected to exist on planets like Venus and Mars; this discovery has implications for our understanding of planetary atmospheres beyond Earth, including the thousands of exoplanets we are now beginning to explore.

This electric field is bidirectional, or "ambipolar," because it works in both directions. Ions pull the electrons down with them as they sink with gravity. At the same time, electrons lift ions to greater heights as they attempt to escape to space, like a tiny dog tugging on its sluggish owner's leash. The net effect of the ambipolar field is to extend the height of the atmosphere, lifting some ions high enough to escape with the polar wind.

Credit: NASA/Conceptual Image Lab/Wes Buchanan/Krystofer Kim

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