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π IN THE SKY 8

How strong are the forces behind Earth's auroras? NASA solves this real problem to explore Earth and space and – with pi as your guide – so can you!

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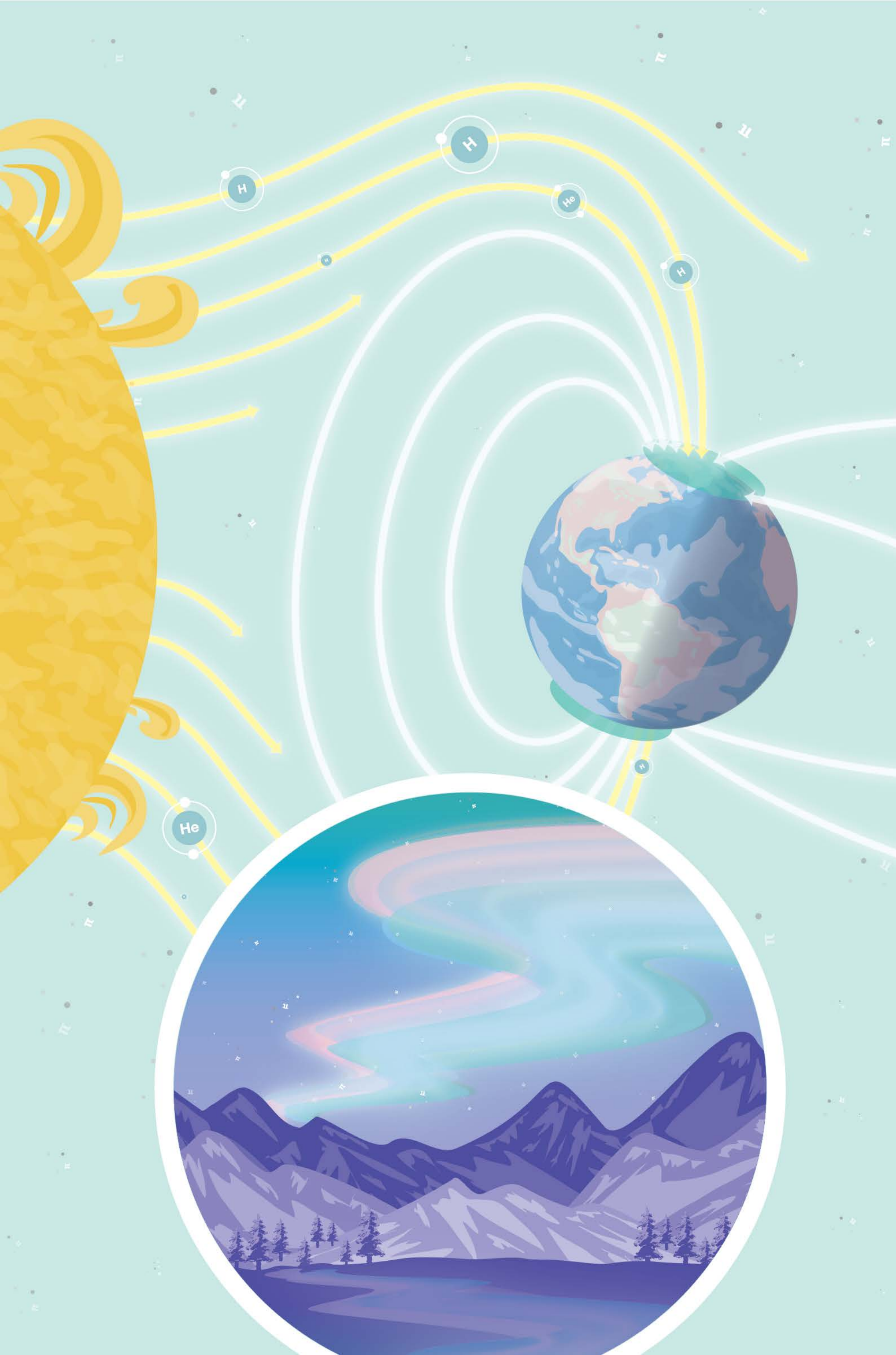

FORCE FIELD

Every day, Earth is showered in radiation from the Sun. The Sun also emits charged particles almost entirely in the form of ionized hydrogen and helium. These ions travel at speeds of about 400 km per second but rarely reach Earth's surface. That's because they are deflected by Earth's magnetic field due to the Lorentz force, given by the equation: $F = qvB\sin\theta$ where **F** = force (N), **q** = charge of the particle in coulombs (C), **v** = velocity of the particle in meters per second (m/s), **B** = the magnetic flux density of Earth's magnetic field in teslas (T) and θ in radians. The charged particles can't cross Earth's magnetic field, so they follow it to the North and South poles. The resulting concentration of charged particles is what creates auroras.

If Earth's magnetic flux density is 60μT, what force would a hydrogen ion observe at π/4 radians from the equator? What about at the North Pole (π/2 radians)?

Does the relative magnetic field agree or disagree with what you'd expect about the location of auroras?

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