## THE HAZARDS OF OUR STAR

**Q: How does the Sun's magnetic field affect Earth? — Kyle Norris,** Peoria, Arizona

**A:** The Sun's magnetic field permeates its atmosphere — ranging from the solar photosphere (the visible "surface") to the corona above. Think of this field as a collection of invisible rubber bands that are slowly stretched and twisted until they eventually reach a breaking point. When the field breaks, it releases a small amount of energy, known as a nanoflare. Millions of nanoflares occur every second, and the combined effect heats the solar corona to more than 1 million kelvins, hundreds of times hotter than the photosphere. **The super-heated gas emits X-ray and ultraviolet radiation; Earth's upper atmosphere absorbs it, which changes our atmosphere's properties. This can disrupt communication, navigation, and surveillance systems, and also alter the orbits of satellites.**

On much larger scales, huge sections of the corona explosively erupt in coronal mass ejections (CMEs) and solar flares. **CMEs directed toward Earth cause geomagnetic storms, which can wreck havoc on electrical power grids and produce widespread blackouts.** Highly energetic particles can damage or even disable critical spacecraft components. Intense radiation from flares has the same effects as nanoflares, but to a greater degree. The need to understand how solar phenomena impact Earth has led to an important science field called space weather. — **James A. Klimchuk,** NASA's Goddard Space Flight Center, Greenbelt, Maryland

Caption:
**X-ray and ultraviolet radiation**, energetic particles, and magnetized plasma clouds from a solar flare or a coronal mass ejection can cause electrical grid blackouts, disrupt navigation systems, and even disable spacecraft components. Solar Dynamics Observatory