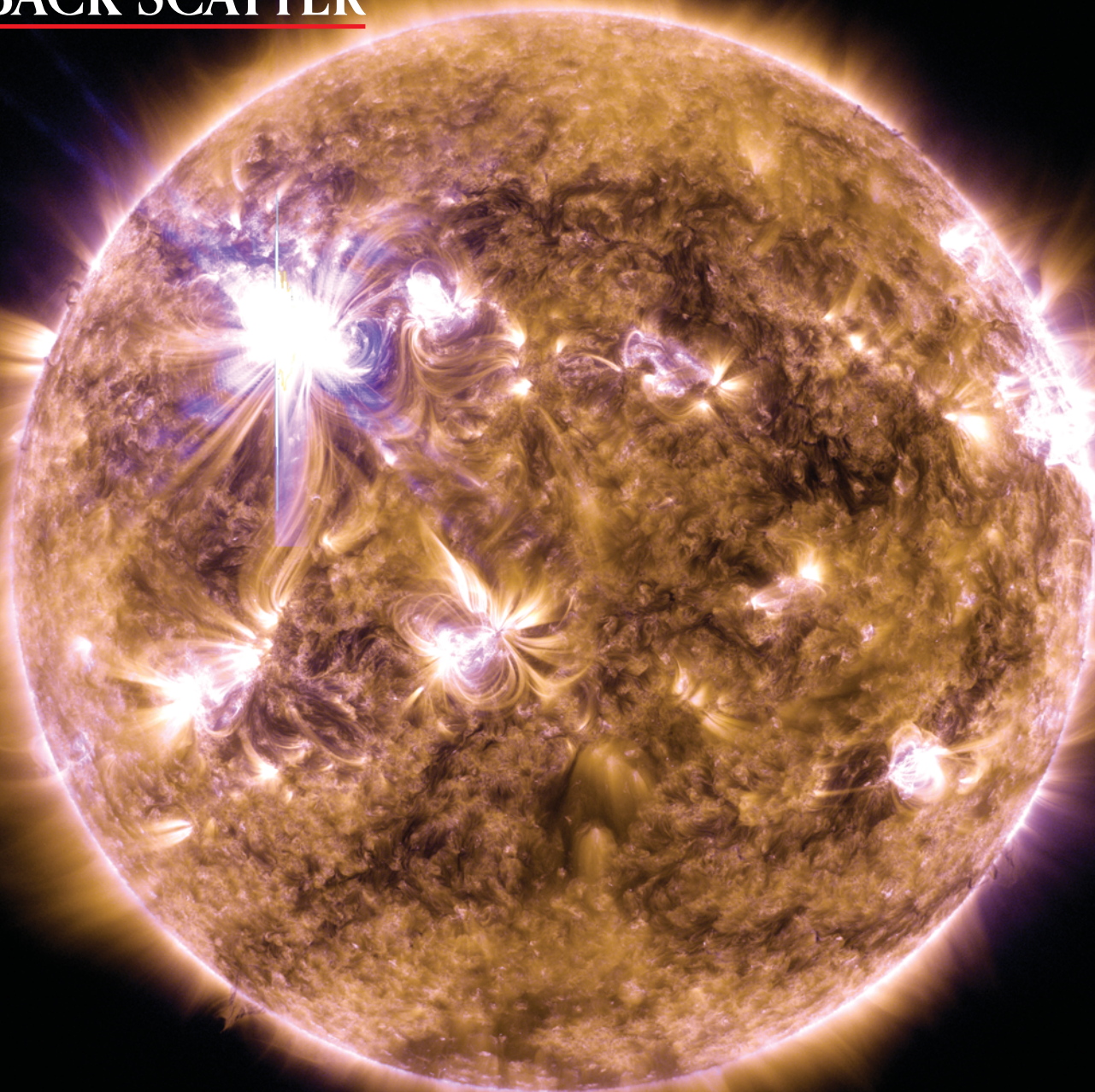




Predicting large solar flares

A solar flare can reach Earth in about eight minutes, and its impulsive radiation can harm astronauts in space and technology on the ground. Physicists have constructed various empirical models to explain the occurrence and properties of solar flares, but their accuracy remains low. Kanya Kusano of Nagoya University in Japan and his colleagues considered solar flares from a mechanistic, physics-based approach. In their concept, magnetic reconnection triggers a double-arc magnetic loop instability that then disperses some of the free energy released during a solar flare. Following that line of reasoning, Kusano and his colleagues developed a flare model that provided lead times of a few hours to an entire day.

One of the flares they used to test their model is pictured here in the upper left area of the image and occurred in 2012. To better understand such large flares, the researchers tuned their model using what they call the κ parameter, which estimates the length scale and the region where the magnetic reconnection can trigger the instability. They also used κ to estimate the magnetic free energy that can be released by the double-arc loop. When the researchers compared their simulations with magnetic location data collected by NASA's *Solar Dynamics Observatory*, they found the model successfully predicted the occurrence and size of seven of the last nine largest solar flares. (K. Kusano et al., *Science* **369**, 587, 2020; image courtesy of NASA's Goddard Space Flight Center/SDO.) —AL

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