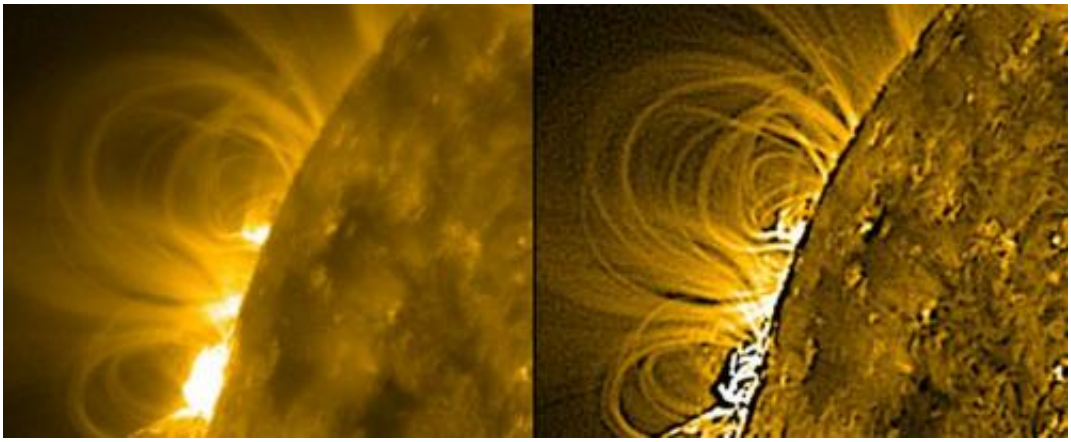
Heliophysics nugget: Gradient sun

October 19 2012, by Karen C. Fox



The image on the left shows the sun on Feb. 24, 2011 as observed by NASA's Solar Dynamics Observatory. The image shows light emitted by million degree plasma, a temperature that is particularly good at highlighting fine arcs in the sun's atmosphere called coronal loops. The image on the right shows the same image after being processed with a gradient filter that enhances the loops even more for research purposes. Credit: NASA/A. Young

(Phys.org)—Heliophysics nuggets are a collection of early science results, research techniques and instrument updates that further our attempt to understand the sun and the dynamic space weather system that surrounds Earth.

Watching a particularly beautiful movie of the sun helps show how the lines between science and art can sometimes blur. But there is more to the connection between the two disciplines: science and art techniques are often quite similar, indeed one may inform the other or be improved

based on lessons from the other arena. One such case is a technique known as a "gradient filter" – recognizable to many people as an option available on a photo-editing program. Gradients are, in fact, a mathematical description that highlights the places of greatest physical change in space. A gradient filter, in turn, enhances places of contrast, making them all the more obviously different, a useful tool when adjusting photos.

Scientists, too, use gradient filters to enhance contrast, using them to accentuate fine structures that might otherwise be lost in the background noise. On the sun, for example, scientists wish to study a phenomenon known as coronal loops, which are giant arcs of solar material constrained to travel along that particular path by the magnetic fields in the sun's atmosphere. These loops can vary in complexity over the sun's 11-year activity cycle, becoming more or less intertwined and inter-connected. Observations of this phenomena can help researchers understand what's happening with the sun's complicated magnetic fields that can also power great eruptions on the sun such as the solar flares or coronal mass ejections. The images above show an unfiltered image from the sun next to one that has been processed using a gradient filter. Note how the coronal loops are sharp and defined, making them all the more easy to study.

Video: Using a gradient filter on imagery captured by NASA's Solar Dynamics Observatory (SDO) helped create this stunning display of sharply defined coronal loops on the sun next to fuzzier, cooler areas that are sometimes referred to as "moss" due to their moss-like appearance. Credit: NASA/Goddard Space Flight Center

Figuring out how to best process scientific imagery takes experts of all types working together to devise the new and improved methods. For example, experts in statistics, computer recognition and image processing have all come together regularly for the last nine years at

Solar Information Processing workshops to focus on sharing state-of-the-art imaging techniques that can best further scientific research.

And, of course, gradients also make great art. Through careful adjustment of gradient algorithms on this movie from NASA's Solar Dynamics Observatory, sharp loops of solar material on the sun pop out visually next to more fuzzy areas in the sun's atmosphere, providing a dazzling show.

Provided by NASA