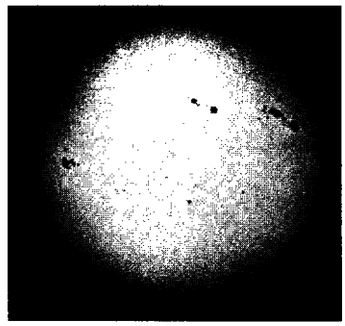
records, she estimated that TSI has increased over the past 300 years at an average rate of only 0.008% per decade, less than one-quarter Willson's observed rate (*Science*, 8 March 1996, p. 1360). In fact, Lean inferred that the brightening of the sun over the past few decades has been negligible.

"That doesn't mean [Willson's finding] is wrong," Lean says, but it does mean that something other than changes in sunspots and faculae would be needed to produce the greater variability. But Willson is not worried about being forced to think about new mechanisms. Lean's dark-bright mechanism "works in a part of the solar cycle," says Willson, "but it doesn't work as well during solar maximum or minimum." To him, that suggests something apart from Lean's mechanism is also varying brightness within a solar cycle.

More worrying to some researchers are two studies, each of which claims to have found additional jumps in the ERB record that Kyle and Hoyt missed. The two studies—published within the past 2 years by Robert Lee of NASA's Langley Research Center in Hampton, Virginia, and his colleagues and by Gary Chapman of California State University in Northridge and his colleagues—use multiple proxies for TSI, such as solar radio emissions and the area encompassed by sunspots, faculae, and network. They then searched the ERB record for jumps that did not appear in the proxy records. Each group, although using a different mix of proxies and different data sets, identified similar spurious discontinuities in the ERB record at about the same times during the gap. If these two discontinuities are used to correct the ERB record, Willson's brightening trend would fade to near zero.



P. CHARBONNEAU AND O. R. WHITE/NCAR

An imperfect sun. Sunspots help modulate the sun's brightness.

"I can get either result, depending on how I do it," says solar physicist Dick White of the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. His initial analysis of the ACRIM and ERB data with Werner Mende of the Free University of Berlin gave "basically the same result as Dick [Willson] got," says White.

Lee's proxies had not seemed directly enough linked to TSI to warrant the additional corrections, says White, but 2 weeks ago at a meeting, Lean and Chapman made him aware for the first time of the full implications of Chapman's 1996 paper. White was impressed by the more direct connection between Chapman's proxies and TSI. Now, after using the proxies to correct the ERB record, White thinks "the final conclusion will be that the TSI has changed by less than" a fifth of the value reported by Willson.

But Willson, who became aware of the implications of the Chapman paper only last week, isn't persuaded. "ACRIM data are fundamental physical measurements," he says. Correlating proxies to TSI "is a statistical construct, not physics. I don't think this kind of analysis can give you precise insight into a subtle trend like this." The proxy indices have not been measured as precisely as TSI has, says Willson, and the physical relation of TSI to the kinds of solar activity reflected in the indices is not well understood. "When people tell me these statistical indices are better than the observations, I just can't see it. This is a classic difference between experimentalists and theoreticians," he says.

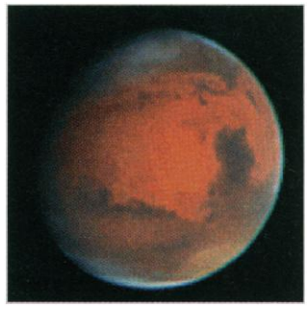
A middle ground in the debate may be emerging, however. After analyzing the combined ACRIM/ERB data and including the additional corrections, Frohlich finds no brightening. But that doesn't make him a critic of Willson, either: "I'm not saying one or the other is correct; we're just doing things differently." What is needed, says Frohlich, is ACRIM-type instruments that could span two solar minima. But that means researchers will have to wait at least another decade before deciphering the sun's role in global change.

–Richard A. Kerr

PLANETARY SCIENCE

Martian Magnetic Whisper Detected

Planetary scientists knew that Mars was no magnetic powerhouse, but for decades they have been frustrated in their efforts either to write it off as magnetically inert like Venus or active like Mercury and Earth. Last week, the Mars Global Surveyor provided the long-sought answer during one of its first low passes over the planet.



P. JAMES/UNIV. OF TOLEDO & S. LEE/UNIV. OF COLORADO/NASA/HST

Magnetic after all. Mars proves to be magnetic but still mysterious.

"It looks like strong evidence for a planetary magnetic field," says space physicist Mario Acuña of NASA's Goddard Space Flight Center in Greenbelt, Maryland, who is the principal investigator for Surveyor's magnetometer. Previous missions to Mars carried magnetometers that weren't sensitive enough to pick up the field, met with disasters like the 1993 loss of Mars Observer, or, like the 1989 Russian Phobos spacecraft, did not pass close enough to the planet, says Acuña.

But Surveyor's discovery came with a puzzle: At about 1/800 the strength of Earth's field, Mars's magnetism is surprisingly strong. That's about twice as strong as researchers thought it could be based on limits inferred from Russian missions, says Acuña. Planetary physicist David Stevenson of the California Institute of Technology in Pasadena adds that "it's not that easy to get as large a field as the spacecraft has found." Indeed, it's hard to figure out how Mars could be generating any field, let alone one of the strength that Surveyor has detected.

Theoreticians assume that Mars is too small to have retained the internal heat needed to drive an Earth-like magnetic dynamo, in which the churning of a molten-iron core produces electrical currents and thus the magnetic field. If Mars ever had an Earth-like dynamo, says Stevenson, it's likely it has turned off. Stevenson has speculated that Mercury's field might be generated thermoelectrically, as in some batteries, if temperature differences across an iron core and rocky mantle could produce a closed electrical circuit. The same process might be at work in Mars, he suggests. Even so, some sort of dynamo would be required to enlarge the internal field into one detectable above the planet.

Another possibility is that Mars imprinted a field on its crustal rock before the planet's geodynamo wound down, and Surveyor is picking up those imprints. Remnant magnetism has been reported in meteorites from Mars, including ALH84001 with its putative evidence of ancient life. (Indeed, if Mars did have an early, strong field, it might have fended off cosmic rays deleterious to life.) But "it's hard to imagine how you would build up a large, coherent field" from remnant magnetization, says Stevenson. Earth's moon, for example, has remnant magnetism frozen into lavas when they solidified, but it's patchy and doesn't add up to a global field.

Surveyor will map the field in detail as it settles into orbit around the planet, and its observations could "sort out whether it is a remnant crustal field or a dying dynamo," says Acuña. "We have a long way to go."

–Richard A. Kerr