But although "the olfactory system is certainly a specific place where cofiring of neurons means a lot," says Hadassah's Abeles, he would like to see more evidence in other systems that the brain is really using the information encoded in the synchrony. Singer argues that his binocular rivalry experiments make a good case that it is. "Since it is such a strong predictor of perception, I can't imagine that the brain ignores synchrony," he says. "It is inconceivable. It would be like saying that the brain ignores firing rate."

Despite arguments such as Singer's, some researchers remain skeptical about the function of synchronous firing in the brain. It may just be a product of neurons changing their firing rates at the same time, argues neuroscientist Michael Shadlen of the University of Washington. Like a group of people who all start to run at once, their first few steps may be nearly in unison.

Researchers who study synchrony often find no change in the firing rates of neurons when they synchronize, but Shadlen notes that changes in firing rate can only be seen when they are time locked to something the researcher controls, such as the appearance of a cue on a computer screen. That's because the only way to measure firing-rate changes accurately is by averaging the response of neurons over many trials. If the neurons are changing their rate in response to something the experimenter doesn't control, such as when a monkey happens to make up its mind, says Shadlen, that event may change with each trial, and consequently the rate change may be invisible to the experimenter.

In that case, says Shadlen, studying synchrony would still be important, because it can reveal mental events researchers otherwise would have no way of detecting. "I'm saying synchrony lets us find the rate changes, and they are saying synchrony is the code," says Shadlen. Regardless of who is right, the study of the synchronous firing of neurons is sure to help researchers record the music of the brain for years to come.

–Marcia Barinaga

Additional Reading

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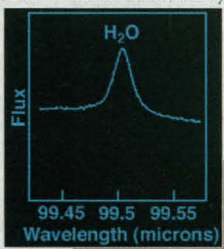
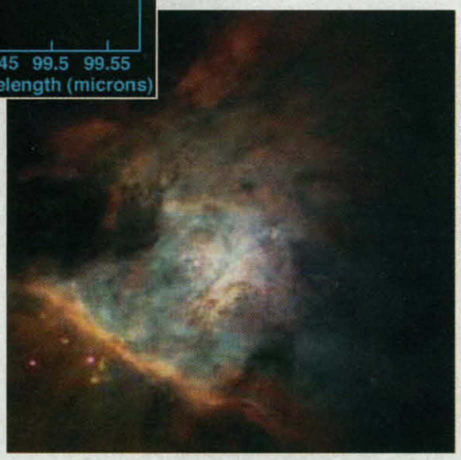
INFRARED ASTRONOMY

# A Water Generator in the Orion Nebula

The discovery is too distant for seaside vacations and too tenuous to be considered a natural resource. But when, like an orbiting dowser, instruments aboard the Infrared Space Observatory (ISO) picked up an intense glow from a cloud near the Orion Nebula, astronomers knew they had found a concentration of water that makes the Pacific Ocean look like a drop in the bucket. The measurement, which will be reported in the 20 April issue of *Astrophysical Journal Letters*, turned up the highest concentration of water ever seen outside the solar system.



EUROPEAN SPACE AGENCY / NASA

**Damp shock.** Infrared signals *(inset)* indicate that shock waves from a young star in Orion are inducing hydrogen and oxygen to combine.

The find confirms theories of how shock waves heat such clouds and induce oxygen to combine with hydrogen and form water vapor. "There was no observational confirmation until now," notes Bruce Draine of Princeton University, who says the field would have been "dumbfounded" if ISO had come up dry when it pointed its instruments at Orion. In two press releases, the team suggests that the find also offers clues to how water collected in the solar system and on Earth—a speculation that leaves researchers like Draine feeling skeptical.

Most previous detections of water outside the solar system have relied on naturally occurring masers—the microwave equivalent of lasers. Because even minute amounts of water can give large maser emissions, pinning down the concentrations has proved impossible. Instead, ISO's Long Wavelength Spectrometer captured infrared emissions from water vapor caused by thermal agitation. (The measurements couldn't be made from the ground because of the veil of water in Earth's atmosphere.) "We have eight different wavelengths at which water is emitting," says David Neufeld of The Johns Hopkins University. "That gives us a completely unequivocal signature that it's water we're seeing."

The team—Neufeld, Martin Harwit of Cornell University, Gary Melnick of the Harvard-Smithsonian Center for Astrophysics (CfA), and Michael Kaufman of NASA Ames Research Center—pointed the instruments to an area in the cloud about a third of a light-year across, near which lies a hot, young star in a nursery of stellar formation called Orion BN-KL. Such stars throw off powerful winds and jets, driving shock waves when they collide with surrounding material. According to theory, the shocks heat the gas, speeding up chemical reactions that cause all of the free oxygen to combine with hydrogen atoms—by far the most abundant species—into water.

At about 2000 kelvins, the shocked gas seen by ISO is well above the threshold for that process to take place, says Neufeld. The precise levels of water that were measured—about 20 times denser, compared to the hydrogen, than ISO had ever seen before—"are in essentially perfect agreement with theory," he says. "With the radio masers you are seeing little, tiny diamonds" of emission, says James Moran of CfA. "Now it seems that this exists on a scale 100,000 times larger."

"It's an exciting discovery," agrees CfA's Alex Dalgarno, the editor of *Astrophysical Journal Letters*. But even though Neufeld calculates that the shocks in the cloud are creating water at a rate fast enough to fill Earth's oceans 60 times a day, Draine and Dalgarno cast doubt on the more speculative idea that water from such a cloud might find its way into a forming planetary system. "This at least raises the possibility, [but] how would the water survive the formation of the solar system?" asks Dalgarno.

Shocks within the forming system are a more likely candidate, says Draine. Neufeld agrees that the hypothesis of shocks as the source of our water should be considered "just as a general notion" and not solely as a way of sprinkling the solar system with primordial water. But for observers who have been thirsty for a good look at water in space, that could be enough to tell them the surf's up.

–James Glanz