long thought they have the same composition as Earth's rock. So Boyet and Carlson assumed that the newly recognized neodymium gap arose soon after Earth formed, as a result of chemical reactions that separated samarium from other elements. Samarium is a radioactive progenitor of neodymium.

But in one of this week's papers, geochemists Michael Ranen and Stein Jacobsen of Harvard University report that the solar nebula was isotopically heterogeneous in the first place. The evidence comes from barium, one of the elements that swirled into the solar nebula after being forged by nuclear reactions in a dying star. The authors find more of some barium isotopes in chondritic meteorites than in rocks on Earth even though the barium isotopes—unlike the neodymium isotopes—are not the products of radioactive decay. Somehow, they say, some of the newly minted elements did not get thoroughly mixed into the nebula before the asteroids formed. As a result, the chondritic meteorites cannot be trusted as a benchmark for the starting composition of the whole Earth, they conclude, contrary to Boyet and Carlson's assumption. Earth's initial composition "becomes a more complicated puzzle to figure out," Jacobsen says.

The authors of the second online paper—geochemists Rasmus Andreasen and Mukul Sharma of Dartmouth College—also found signs of a heterogeneous solar nebula, but with a twist. They revisited the neodymium and samarium isotopes of chondritic meteorites. They found that the most primitive sort, the carbonaceous chondrites from the far edge of the asteroid belt, contain a mix of neodymium isotopes different from that in ordinary chondrites from the inner part of the belt.

Carbonaceous chondrites are definite oddballs, Andreasen and Sharma conclude. But they see signs in neodymium and samarium isotopes that Earth and ordinary chondrites grew from the same sort of stuff. The difference in neodymium isotopes that Boyet and Carlson noted could indeed have resulted from the early separation of elements on Earth, they say. Andreasen and Sharma's analyses "bolster our claim" about a layered deep Earth, says Carlson. Sharma agrees.

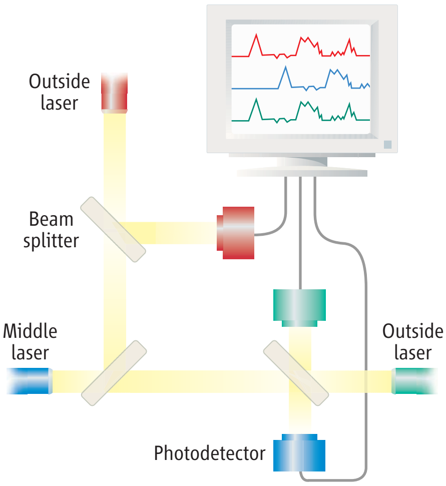
The two new isotopic studies agree in one respect. "What was supposed to be a homogeneous stew was not," says geochemist Gerald Wasserburg, professor emeritus at the California Institute of Technology in Pasadena. "I don't know whether Boyet and Carlson are right or not, [but heterogeneity] threatens all the things one does in that area. Pandora's box is clearly open."

–RICHARD A. KERR

NONLINEAR DYNAMICS

Bizarrely, Adding Delay to Delay Produces Synchronization

Running late? Add more delay, and you can end up right on time—if you happen to be a chaotically varying beam of laser light. When three lasers in a row shine into one another in just the right way, they can forge a connection in which the intensities of the first and last lasers vary in unison, physicists report. That's weird because if the researchers couple only two lasers, the variations of one simply lag those of the other by the amount of time it takes light to pass between them, as anyone might expect. The strange new effect could shed light on how the hemispheres of the brain stay in sync, researchers say.



Tag team. When three lasers couple, the outer two (red and green) stay in sync as the middle one lags.

"These guys have shown experimentally that this happens," says Rajarshi Roy, a physicist at the University of Maryland, College Park. "Explaining mathematically why this is possible is an open question."

When two lasers shine into each other, their intensities can start to vary randomly. The heart of each laser is a "resonant cavity" in which light begets more light in a process called stimulated emission. Within one laser, light from the other laser can interfere with the light already in the cavity, either increasing or decreasing the overall intensity. That change, in turn, increases or decreases the output of the laser and hence the amount of light beaming back into the other one. Such feedback can trigger chaotic oscillations in the intensities of both.

Ingo Fischer of the Free University of Brussels, Belgium, and colleagues previously had shown that when two lasers couple, the fluctuations in one always lagged the other. But when the researchers added a third laser to the chain—so that the lasers on the ends shone into the one in the middle and the one in the middle shone into those on the ends (see diagram)—they got a surprise. The laser on one end instantaneously reproduced the variations of the laser on the other end, even as the middle laser trailed behind by 3.65 nanoseconds, the time it took light to travel the 1.1 meters between neighboring lasers, the team reports in the 22 September *Physical Review Letters*.

The effect might conjure up thoughts of faster-than-light communication, but that's not possible, Fischer says. The random variations are produced by the system as a whole, so it is impossible to feed a message into one end of the chain and immediately extract it from the other, he says.

Although it may not challenge the laws of physics, the experiment could help decipher the synchronization of nerve signals in the brain, says Wolf Singer, a neuroscientist at the Max Planck Institute for Brain Research in Frankfurt, Germany. In 1986, Singer and colleagues showed that networks of neighboring neurons tend to fire at the same time, and 5 years later they showed that such tight synchrony extends to the opposite hemispheres of the brain—even though it takes 6 to 8 milliseconds for nerve impulses to propagate that far.

Such synchronization may help define individual neural circuits, Singer says, and researchers can already explain how local networks of neurons get in sync. "What is less well understood is how remote sites get synchronized," Singer says, "and that's where this work may be relevant."

Analyzing the effect may not be easy, says Jürgen Kurths, an expert in nonlinear dynamics at the University of Potsdam in Germany. Without the delays, the coupled lasers can be described with a finite number of equations. Add the delays, and "in theory you have an infinite number of equations, so it becomes quite difficult," Kurths says. Understanding will come, he says, but it may take time.

–ADRIAN CHO

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