

er, much as air gets compressed when a jet produces a sonic boom. Gumbsch and Gao report their findings in the Feb. 12 SCIENCE.

"People have done simulations before to see if dislocations can propagate superpersonally, but they failed," says Gao. The reason the new one succeeds is that the blow was hard enough to set up a fast initial dislocation. "If you start with a very slow dislocation, you cannot accelerate to a supersonic speed," he explains.

Supersonic movement of dislocations may play an important role in distortions of steel at low temperatures, Gumbsch says. It may also explain seismic shocks that have been observed to travel faster than the speed of sound.

"I believe all of the work, and I like it," says Michael Marder, a physicist at the University of Texas at Austin who models cracking in materials. Other computer simulations "assume that dislocations basically creep along and diffuse. It's significant to show that they can move at speeds comparable to the speed of sound."

Atomic-scale simulations give researchers an invaluable tool with which to study these phenomena, Marder says. It's difficult to image micrometer-size defects zipping along in a real crystal, he points out. "Small things that move fast are really a problem." —C. Wu

Feds plan battle against aliens

Creeping, crawling, tendril-snaking alien species have been invading the United States. Zebra mussels, transplants from Eurasia, thrive so well in the Great Lakes that they shut down power plants by clogging their water-intake valves. In New York and Chicago, Asian long-horned beetles topple shade trees. European leafy spurge is smothering western U.S. farm and grazing land, and Australian pines and Brazilian pepper trees are slurping up Florida's fresh water.

On Feb. 3, President Bill Clinton signed an executive order to coordinate the federal fight against such exotic invaders. The action establishes no new regulations or policies but creates an Invasive Species Council led by the secretaries of commerce, agriculture, and the interior. The council has 18 months to formulate a comprehensive plan.

It won't be easy to control invasive species or stem their influx. Introduced species with short reproductive cycles, voracious appetites, or no local enemies can quickly dominate an eco-system. The Nature Conservancy estimates that, next to habitat loss, invasive species pose the direst threat to native populations. Damage and losses due to these aliens add up to about \$123 billion a

No beginning in sight for star formation

It kept going and going and going . . . As far back in time as astronomers can observe, the cosmos was churning out stars at a prodigious rate, a new study reveals.

Scientists believe that as they peer ever deeper into space and farther back in time, they will eventually come upon the epoch when star formation was not yet in full bloom. However, "we haven't found that place yet," says Charles C. Steidel of the California Institute of Technology in Pasadena. "The universe was remarkably consistent [in making stars] for a fairly large amount of cosmic time."

As far back as 12 billion years ago, when the universe was perhaps 16 percent of its current age, the cosmos was producing stars at a rate about 10 times higher than it does today, Steidel says. The prolific star formation lasted until about 7 billion years ago. Steidel presented his team's findings Jan. 30 at a cosmology workshop in Chicago.

Moreover, an analysis by another team suggests that the cosmos was making stars just as rapidly when it was even younger, about 9 percent of its current age. Piero Madau of the Space Telescope Science Institute (STScI) in Baltimore and his colleagues report their results on the Internet (<http://xxx.lanl.gov/abs/astro-ph/9809058>).

The findings contradict a previous report from a team led by Madau and including Steidel. It counted faint, faraway galaxies in the tiny patch of sky called the Hubble Deep Field, which was scrutinized by the Hubble Space Telescope.

year (SN: 2/6/99, p. 91).

Many alien species hitchhike in cargo and stow away in ships' ballast water. "Thousands of species are in motion every day in ballast water," says marine biologist James T. Carlton of Williams College's maritime program in Mystic, Conn. Currently, ships are asked to voluntarily exchange their ballast water far out to sea—a stop-gap measure, he says. Research into filtration, ultraviolet radiation, and thermal treatments may reveal a better method to "bake, remove, fry, or otherwise render ballast water as abiotic as possible," says Carlton.

International trade treaties, such as the North American Free Trade Agreement, increase the volume of shipments and so add to the risk of introducing pests. It's important that the Invasive Species Council address trade issues as it coordinates the dozens of federal agencies with a stake in the battle against exotic species, says biologist Daniel Simberloff of the University of Tennessee in Knoxville.

"We need an early-warning system to pick up species when they first become

The team compared this number with a tally of closer galaxies observed by ground-based telescopes. The scientists calculated that star formation reached its zenith when the cosmos was roughly half its current age and was considerably less at earlier times.

Steidel's team has now used ground-based telescopes to search a region 200 times the area of the patch of sky viewed by Hubble. The researchers were surprised to find that star formation remained constant throughout the observable early cosmic history. The findings may only apply to relatively bright galaxies since the telescopes Steidel used could not observe galaxies as faint as those as seen by Hubble.

The researchers now assert that the Hubble Deep Field is simply too small a sample of sky to provide an accurate assessment of star formation. Previous observations by Steidel's team have revealed that massive galaxies in the early universe bunched together tightly (SN: 2/7/98, p. 92). The Hubble field happens to be a region where few galaxies cluster, Steidel suggests.

In a study supporting that assertion, Stefano Casertano and Henry C. Ferguson of STScI and their collaborators counted the number of faraway galaxies in another patch of sky viewed by Hubble. They reported last month in Austin, Texas, at a meeting of the American Astronomical Society that they had found a star-formation rate comparable to Steidel's and about double that found in the original Hubble Deep Field. —R. Cowen

Zebra mussels, voracious Japanese shore crabs, and cholera bacteria have traveled to U.S. harbors in ballast water.

invasive," says biologist E.O. Wilson of Harvard University.

Even brigades of biologists can't catch every alien invasion as it happens. "We want to alert fishermen, boaters, highway workers, people who have developed a familiarity with a community of organisms," says Bob Peoples of the U.S. Fish and Wildlife Service in Arlington, Va. "When something new shows up, we want them to talk to their state fish and game department." —L. Helmuth



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