Astronomy

Ron Cowen reports from College Park, Md., at a workshop on Comet Shoemaker-Levy 9

Points of impact: Observers get a break

When the roughly 20 fragments of Comet Shoemaker-Levy 9 plunge one by one into Jupiter next July, each will hit the planet's backside: None of the explosive impacts will be visible from Earth. But new calculations, based on additional observations of the train of fragments, indicate that the pieces will strike closer to the limb, or outer edge, of Jupiter than originally thought.

Each impact site will thus take less time to rotate into view, giving astronomers some hope of directly observing more of the short-lived atmospheric disturbances triggered by each collision.

Paul Chodas and Donald K. Yeomans of NASA's Jet Propulsion Laboratory in Pasadena, Calif., had previously calculated that the collisions would all occur about 30 degrees behind the limb. At that location, it would take the points of impact roughly 75 minutes to rotate past the limb and another 16 minutes to become clearly visible from Earth. In contrast, the revised calculations show that the collisions will occur only 6 degrees behind the limb. Thus each impact site will cross the limb in just 18 minutes and come into full view 16 minutes later.

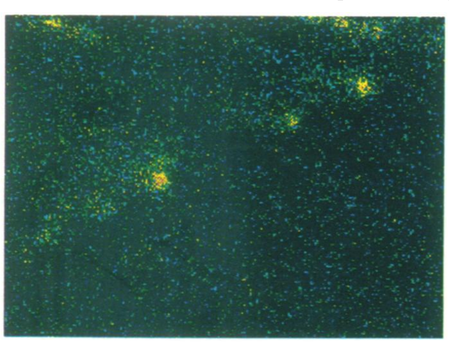
Data collected since December, when the fragments moved far enough from the sun's glare that ground-based telescopes could once again detect them, helped improve the accuracy of the calculations, Chodas says. For the Galileo spacecraft, which will be the closest craft to Jupiter in July, the revised location means the difference between just barely observing the impacts and detecting them clearly.

"It's now clear that Galileo will have a direct view of the impact sites," says Clark R. Chapman of the Planetary Science Institute in Tucson, Ariz. He notes, however, that astronomers will have to plan observations with Galileo carefully, since its crippled high-gain antenna will make it difficult to send images.

Though excited about the prospect of viewing the aftermath of the collisions sooner, Heidi B. Hammel of the Massachusetts Institute of Technology notes one disadvantage of the newly calculated location. Astronomers are hoping to indirectly observe the fireballs expected to erupt seconds after each impact by recording the flashes of light reflected off the surface of three of Jupiter's moons — Io, Europa, and Callisto. In the revised location, the collisions will still be reflected, but they won't appear as bright as previous calculations had indicated, Hammel says.

Shoemaker-Levy in the infrared

Using the NASA Infrared Telescope Facility atop Hawaii's Mauna Kea, astronomers on Jan. 5 obtained the highest-resolution infrared image to date of Comet Shoemaker-Levy 9. Michael F. A'Hearn and Philip Esterle of the University of Maryland at College Park took the image shown here at a wavelength of 1.25 microns; they took a second image at the slightly longer infrared wavelength of 2.2 microns. By comparing the dust emissions surrounding each fragment in those two images with emissions in pictures to be taken by other astronomers at wavelengths ranging from the ultraviolet to the far infrared, researchers hope to determine if Shoemaker-Levy 9 behaves more like a comet than an asteroid, A'Hearn says.



A'Hearn, Esterle/U. of Md.

Biomedicine

Imaging an enzyme that shapes DNA

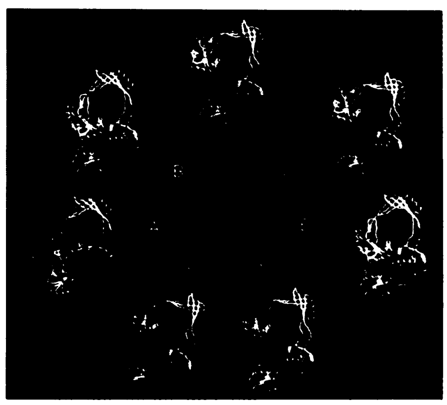
Images: Mondragón/Northwestern

Inside a cell's nucleus, DNA molecules undergo constant renovation — twisting into tightly tangled messes, then unwinding — in a never-ending do-si-do with various molecules, many of which help DNA function. The callers in this nuclear dance hall are enzymes called topoisomerases. They guide DNA into coils, then help this double-stranded helix straighten out, or "relax."

X-ray crystallography has now revealed the atomic structure of a critical part of one of the relaxing callers, topoisomerase I, from the bacterium *Escherichia coli.*

The computer image above shows how the enzyme fragment (white) folds into four sections, creating a hole big enough to encase double-stranded DNA (multicolored), say Alfonso Mondragón and Christopher D. Lima of Northwestern University in Evanston, Ill. They and Harvard University collaborator James C. Wang had decided to study this fragment after realizing it was common to topoisomerases of several organisms. They describe their effort in the Jan. 13 NATURE.

The researchers have also modeled the enzyme's activity (left). Their work and biochemical studies done in other laboratories suggest that an amino acid (red) located at the junction of two sections of this fragment (lavender) can attach to and break (B) a single DNA strand (green). This action causes the enzyme to open (C). Double-stranded DNA (viewed from above) rushes in (D), then causes the enzyme to snap shut and reconnect the split DNA strand (E). The enzyme then reopens (F), releasing all the DNA (G). This activity allows one part of DNA to pass through another so it can untangle and relax.



The model should help in the design of antibiotics or anticancer drugs that interfere with this enzyme, says Mondragón.

Mutation reveals skin's exposure to sun

Because ultraviolet light can damage genes, exposure to sunlight can increase the risk that an individual will develop skin cancer. Now, scientists can quantify that risk by measuring a specific mutation in a tumor-suppressor gene called p53.

Three-quarters of the samples taken from sun-exposed skin of cancer patients have specific changes in the nucleotide building blocks that make up DNA for p53, reports Hisayoshi Nakazawa of the International Agency for Research on Cancer in Lyon, France, and his colleagues. Almost no DNA from nonexposed skin of those patients or from the skin of people who spend less time outdoors in the sun had this mutation, they report in the Jan. 4 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.