Galileo probe poised to plunge into Jupiter

For 4 months, scientists have monitored the progress of a 339-kilogram body hurtling toward Jupiter. On Dec. 7, traveling 50 times faster than a bullet, the massive object will dive into the giant planet's atmosphere.

Unlike Shoemaker-Levy 9, which crashed into Jupiter last year, this projectile isn't a comet. Rather, it's the first device ever to explore the interior of one of the giant outer planets. During a 75-minute broadcast to its mother craft overhead, the conical probe is expected to reveal more about Jupiter than earthlings have ever known before.

The instrument-laden device, which completed a 6-year piggyback ride on the Galileo spacecraft in July (SN: 7/22/95, p.54), will penetrate Jupiter's ammonia clouds at a site 6.5° north of the equator. Decelerating from 170,000 kilometers per hour to less than one-hundredth that speed in just 2 minutes, the probe will plummet into uncharted territory, measuring for the first time the composition of the solar system's largest and most massive planet.

As it descends, the probe will use its mass spectrometer to help determine the composition of the solar nebula. This disk of dust and gas swaddling the infant sun gave rise to the planets.

In the warmer confines of the inner solar system, trace elements from the nebula, including xenon and krypton, vaporized easily and drifted into space. But thanks to Jupiter's enormous gravity and its location in the colder, outer solar system, the planet has retained these elements. The ratio of the isotopes of each trace element on Jupiter should reflect their ratio in the solar nebula, notes probe project scientist Richard E. Young of NASA's Ames Research Center in Mountain View, Calif.

"Jupiter gives us in some sense a Rosetta stone for what the early solar system was like," he says.

The mass spectrometer should also determine what lies beneath the planet's upper cloud layer of ammonia ice. Scientists have conjectured that two additional cloud layers, of ammonium hydrosulfide and water ice, lie directly below, but no one knows for sure. Just in case the probe encounters heavy rains, its antenna has a hole to drain water away, Young notes.

Researchers hope that the probe will unmask the energy source that drives Jupiter's winds and creates their striking banded pattern. Between about 45° south and north of the equator, the winds divide into narrow zones. Every few degrees of latitude, they reverse direction. Curiously, winds at the cloud tops typically blow no faster than about 460 km per hour—considerably slower than winds on three smaller planets, Saturn, Uranus, and Neptune.

Three sources could account for the motion, notes Young: sunlight striking the atmosphere, energy released when water vapor condenses into liquid, or heat left over from the planet's formation. Characteristic shifts in the wavelength of radio signals beamed by the probe back to Galileo will provide an accurate measure of wind speed, Young says. And whether the winds die down relatively high in the atmosphere, at the water-cloud layer, or at much lower depths should indicate the most likely energy source, he says.

Because its main antenna never unfurled, Galileo can't relay the probe's data to Earth immediately. Instead, it will store the information on a tape recorder and in computer memory, transmitting about half of it a few days later. Galileo, which will tour Jupiter and its moons for two years, won't relay all the probe data until January. However, two radio telescopes on the ground will attempt to capture the probe's faint radio signals directly, thereby improving the accuracy of wind speed measurements 10-fold.

The probe itself won't survive much beyond its 75-minute mission. In the November-December PLANETARY REPORT, Young and Jonathan I. Lunine of the University of Arizona in Tucson calculate that after 10 hours, the searing heat at Jupiter's lower depths will have vaporized the probe into individual atoms and molecules. "After telling humans about the nature of Jupiter's atmosphere," the researchers write, "the atoms of the Galileo probe will become a part of that giant planet." —*R. Cowen*

NASA Ames

Drawing of probe parachuting into Jupiter.

Much ado over brew: Linking drink to shape

Yes, Virginia, there really is a beer belly. A study of more than 12,000 U.S. adults has verified that those who drink at least six beers a week are more rotund than their nondrinking peers. In contrast, those who imbibe an equivalent amount of alcohol in the form of wine tend to have tinier tums than nondrinkers.

Before dashing out to wine bars, however, lovers of the grape should heed the researchers' caution that the study, reported in the Nov. 15 AMERICAN JOURNAL OF EPIDEMIOLOGY, doesn't pinpoint the beverages as the cause of the differences in girth. "The question we face now," says epidemiologist Bruce B. Duncan of the University of North Carolina at Chapel Hill, who led the team, "is whether differences in shape originate with the wine or the wine drinker." Something in drinkers' behavior other than choice of beverage could account for the differences.

"Finding that drinking a certain amount of beer really does cause a beer belly would be useful," Duncan says, "because then we'd have something to target, something straightforward that could possibly improve health." A large waist-to-hip ratio has been linked to risk of heart disease. Duncan's research, part of a national study on risk factors for hardening of the arteries, takes a first step in relating drinking habits to shape.

Scientists divided study participants into nondrinkers and regular consumers of beer, wine, or hard liquor. The team recorded sociological data as well as each subject's waist-to-hip ratio.

Of participants who consumed more than six drinks per week, beer drinkers had a slightly larger average waist-to-hip ratio than nondrinkers. Liquor drinkers' average ratio fell between the nondrinkers' and beer drinkers' ratios. Participants who drank wine, however, had smaller waist-to-hip ratios than nondrinkers. Though small, these differences become important in large populations, says Duncan. In a recent large epidemiological study of Iowa women, for example, adding 0.01 to the waist-to-hip ratio increased the risk of death by 4 percent.

The current study's design eliminated sex, race, occupation, education, obesity, and physical activity as sources of the shape differences. What's left may reflect the diet of the drinkers or the drinks themselves. —*M. Centofanti*