

## Keeping up with Voyager 1

At the beginning of the day on Thursday, Nov. 6, the Voyager 1 spacecraft will be 9,300,000 kilometers away from Saturn, with less than a week remaining until the closest approach in its science-laden flyby of the planet. By day's end, the probe will be only 7,900,000 km away, having covered a prodigious 1,400,000 km in a mere 24 hours. Understandably, keeping up with developments in a mission that runs at such a pace is difficult — but fascinating.

Photos taken on the way, for example, get sharper as the spacecraft nears the planet. For every 100,000 km cut off the intervening distance, says project scientist Edward Stone of California Institute of Technology, the photos gain 2 km in resolution; in other words, the smallest detail discernible in a photo taken at a given distance would have had to be 2 km bigger to show up in a photo taken from 100,000 km farther out. Scientists looking at photos taken at the end of Nov. 6 will be able to pick out details 28 km smaller than could be spotted in images from the start of the same day — a difference roughly equivalent to the diameter of either of the moons of Mars.

It was when looking at some Voyager 1 frames taken early in October that project researchers first noted some striking radial features jutting across the generally circumferential pattern of Saturn's rings (see p. 282). In its computer, Voyager 1 was already carrying instructions to photograph the planet at regular intervals so that a stop-motion "movie" could be assembled of Saturn moving through two rotations on its axis. Intrigued by the radial ring features, the scientists radioed up new instructions that re-aimed one rotation's worth of photos to concentrate on the portion of the rings "outboard" from the planet (so that Saturn's bright disk would not overexpose the pictures).

But the movie, whose timing could not be changed within the complicated sequence of instructions for Voyager 1's many instruments, was not scheduled until the last weekend of the month, by which time the spacecraft was much closer — and its photos much sharper.

Looking at the photos, days or weeks before the movie would even be assembled, the scientists indeed saw the radial features in the rings. But in the improved images, according to camera team leader Bradford Smith of the University of Arizona, they found something else: two new satellites — one apparently orbiting about 2,000 km outside the outermost, thin "F" ring, the other about 500 km inside it.

Smith made the announcement on Oct. 28, only a few days after the photos were taken, and the measurements would almost certainly be refined. In fact, said another Voyager team member at the time,

"we could easily find more satellites. I'm afraid to go out for lunch." Still, said Smith, as far as reasonably well-defined satellites go (there are a host of incompletely reconciled observations from earth and from the Pioneer 11 spacecraft that flew by Saturn last year), the new discoveries appear to be Saturn's 13th and 14th. Besides those two, and the "established" nine, there are two more identified from earth-based astronomical photos made in 1966 (now known as 1966 S-10 and 1966 S-11, or the "Fountain-Larson objects," after two Arizona astronomers who identified them), plus another recently discovered in earth-based and Voyager 1 observations to be in the *same orbit* as the long-known moon Dione.

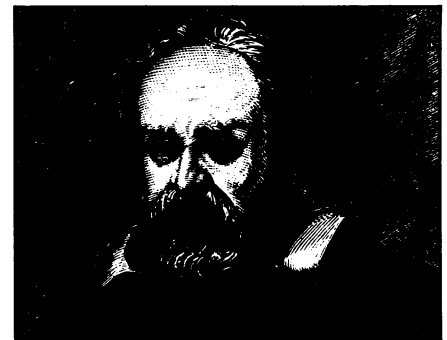
Of course, the number could be different by the time you read this. Another batch of changes to the onboard computer's instructions was recently transmitted to the spacecraft, to target some photos to hunt for new satellites or rings around *Titan* — just in case. In the home stretch of a flyby mission such as Voyager 1's, new findings appear daily, hourly and even minute by minute. By late October, Saturn's rings were looking so complicated, with previously unsuspected variations and concentrations of material, that Smith was already wondering if there might turn out to be a reason for them to look notably different when Voyager 2 flies by next August. The message was clear: Stay tuned. And don't go out for lunch. □

## Decaffeinating FDA list, colas

The legal status of caffeine soon may change. The Food and Drug Administration recently proposed deletion of caffeine as a food additive from its list of substances "generally regarded as safe." In addition to its use in soft drinks, caffeine is added on a limited basis to baked goods, frozen dairy desserts, gelatin puddings and fillings and soft candy — reportedly as a flavoring agent. Under the new proposal, continued use of added caffeine would be permitted pending completion of studies that shed light on its potential negative effects on fetuses and on its possible cancer-causing properties.

In a related action, the agency proposed that a cola soft drink could be a "cola" without caffeine. Under current standards, the presence of caffeine, rather than kola nut extract, is the mark of a true "cola." The new proposal, published in the Oct. 21 *FEDERAL REGISTER*, is designed to promote the production of caffeine-free soft drinks. FDA officials report that use of caffeine in soft drinks "accounts for the vast majority of the estimated 2 million pounds of caffeine added to food annually in the United States." This 2 million pounds does not include the caffeine that occurs naturally in coffee, tea and chocolate. □

## Galileo retrial: Now the world turns



Justice moves slowly at Rome, *ma eppur si muove* (but nevertheless it moves). After 347 years Galileo Galilei will get a new trial. So it was announced on Oct. 22. Galileo was condemned by the Roman Inquisition for teaching as fact the Copernican hypothesis that the sun is the center of the planetary system.

The reopening of the case comes after two decades of effort by Dominique Dubarle, a Dominican friar and priest, as well as an atomic scientist and vice president of the Pugwash Conference. As a Frenchman, Dubarle was able to study the records of Galileo's trial. Inquisition records are usually sealed, but the records of the Galileo trial were taken from Rome by Napoleon and returned by a later French government on the express condition that French scholars be allowed access to them.

Reports say that Dubarle found some grounds in the records for reopening the case. He approached Popes John XXIII and Paul VI about the case but was rebuffed. Pope John Paul II proved more amenable.

As the retrial develops it will be interesting to see just what grounds are brought and how the arguments are managed. It is not simply a case that the Roman Church is ready to admit that the earth revolves around the sun. That admission was made *de facto* centuries ago. Galileo was not condemned for teaching that. He was condemned for teaching it *as fact*.

To use a language developed long after those Inquisitors went to their rewards, they seem to have been concerned with the problem of reconciling the religious *mythos* by which they lived with the scientific modelmaking that was going on. Can both somehow represent the underlying truth or must only one? Their decision was the wimpy one of ordering that scientific models be presented as speculative. (They ordered a censorship of Copernicus's books to that effect as well as condemning Galileo.)

Model versus myth, there have been three centuries of battle, but very few attempts at reconciliation. Galileo's retrial could be a very interesting station in our intellectual history. Or it could dribble away into technicalities of Roman law. □