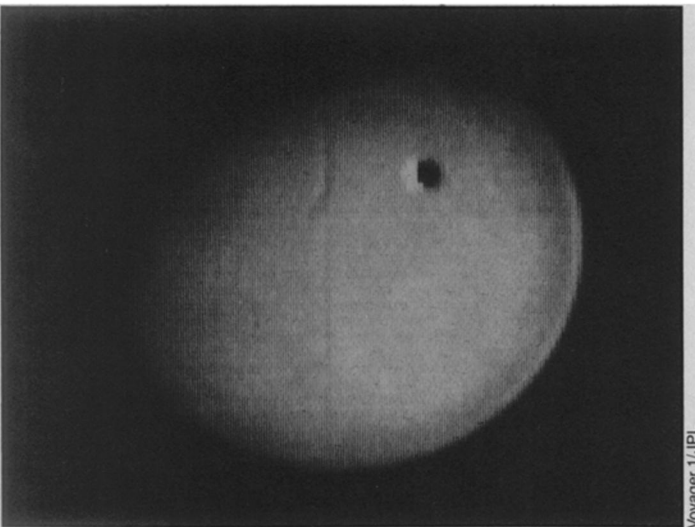


Tethys & Co.: Three moons in one orbit

Tethys, photographed here by Voyager 1, is not merely one of Saturn's many moons, but one of three satellites in the same orbit. The other two have recently been found to pace Tethys around Saturn in orbital positions about 60° behind and ahead of Tethys' own. Black spot is camera artifact.



Voyager 1/JPL

Once upon a time, moons were thought to orbit their host worlds in relatively straightforward fashion, one to an orbit. That idea changed abruptly a year ago, when astronomers discovered that Saturn's moon Dione was sharing its orbit with a companion. Dubbed Dione B, it moves around Saturn in a position centered where the gravity of Saturn and Dione balance at what is called the L_4 libration point, 60° ahead of Dione's orbital position (SN: 5/31/80, p. 340). Then another co-orbiting pair was discovered (unofficially known at the time as S-10 and S-11), whose motion suggests that one of them slowly catches up with the other until the two finally switch places, with the former leader becoming a new trailer.

Now the remarkable family of Saturn has become more complex still, with the finding that the satellite Tethys has not just one companion, but two.

They are tiny objects, each perhaps 30 kilometers across, with one balanced at the L_4 point and the other at the corresponding trailing position, L_5 . Each was photographed several times last year by various observers, and calculations prompted Kenneth Seidelmann and colleagues from the U. S. Naval Observatory to suggest then that they might indeed be the libration-point companions of Tethys. Confirmation has come this year from work by Bradford Smith, Harold Reitsema and others at the University of Arizona (who were also among the original observers of the objects), as well as from independent work by French astronomer C. Veillet. Last month, Veillet observed the trailing companion 29 times on five consecutive nights, and the leading one a dozen times on two nights within the same period, using a telescope at the European Southern Observatory in Chile. The Arizona group, meanwhile, combined its own observations with some from other sources to reach the same conclusion.

The companions of Tethys seem to stay

much closer to their respective libration points than does Dione B, whose lead on Dione varies from as little as 46.7° to as much as 76.7°, Reitsema says. The object ahead of Tethys, by comparison, appears to vary by no more than about two degrees from the stable, 60° position of the L_4 point, while the trailing object follows a somewhat larger oscillation that is not yet fully determined.

Another of Saturn's moons orbits just outside the planet's broad A-ring, apparently keeping the ring's myriad particles from diffusing out to space, while two more satellites circle just outside and inside the skinny F-ring, where they are believed to have a role in keeping the ring the thin ribbon that it is. The various exotic motions of the members of the Saturn family each pose different problems for dynamicists, some of whom might once have thought such phenomena improbable at best. But might there be a relevant perception of another sort? Perhaps one lesson of the Saturn system is simply that, with enough chunks and particles available in a planetary system's early days, almost anything can happen — and, in Saturn's case, it has. □

Another moon for Neptune?

Aiming their telescopes near Neptune on May 24 as the planet's motion carried it close to the apparent position of a star, two teams of observers found that the star's light was blocked off for a period of about eight seconds. Neptune itself was not to blame (the planet was out of position), and other known causes of such blinks — flocks of birds, even earth-orbiting satellites — would have produced much shorter blockages, and probably not been visible to both teams, which were about five kilometers apart in Arizona's

Santa Catalina mountains. One possible explanation: a previously unknown satellite of Neptune, at least 100 km in diameter.

It is not a certainty; an asteroid, orbiting the sun somewhere between Mars and Jupiter, might have done the trick. But the possible satellite, which would have been only twice Neptune's radius from the planet's limb or edge when it was detected (if it is orbiting in Neptune's equatorial plane), lies in a region that is ripe for new discoveries. Most photographic searches for Neptunian moons, says the University of Arizona's Harold Reitsema (one of the observers, along with William Hubbard, Larry Lebofsky and David Tholen), have deliberately blocked out the glare of the planet itself by means of "occluding disks" that covered everything out to about six Neptune radii, leaving the inner reaches yet to be comprehensively scanned.

Even partial confirmation requires waiting for Neptune to pass in front of additional stars — five such occultations are expected to take place in 1983 and 1984 — and even then, says Reitsema, the chances of the same possible satellite being properly aligned with a star are about a million to one. A similar near-occultation by Neptune on May 10, for example, was monitored by several teams, with no reports of unexpected blinks. The real answer, Reitsema says, will come when the space shuttle launches the long-awaited Space Telescope in 1985 to simply "take a look." □

Salyut 6: End or hiatus?

On Sept. 29, 1977, the Soviet Salyut 6 space station was launched into orbit around the earth. In the 44 months since then, it has been occupied more than half the time, serving as home for 16 crews of cosmonauts (one of which stayed aloft for a record 185 days) and being restocked with supplies by a dozen automated Progress supply carriers. The most recent occupants, cosmonauts Vladimir Kovalyonok and Viktor Savinykh, returned to earth on May 26 after 75 days in space, and with that, according to Soviet space officials, "the lengthy program has been fulfilled."

The station is expected to be kept aloft in a mothballed state, although no decision has yet been made about whether additional manned flights will visit it. "At least in the coming months," according to one official, "there won't be any." Furthermore, reports the Soviet news agency Tass, "The planned program of joint research and experiments... prepared by scientists of the countries of the Socialist community has been fully completed." As for the future, Tass described Salyut 6's mission as "an important landmark on the path of the creation of permanently operating manned scientific research complexes."

Officials also announced the end of the Soyuz series of spacecraft, though it was unclear whether that included the modernized Soyuz T series. □