

## RESUME

IMAGE  
UNAVAILABLE  
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REASONS

Neptune and its moon, Triton, in one of Voyager II's last pictures of the Solar System.

lower range of Stern's estimates does not conflict with current cosmogonical models: 1,000 plutons scarcely make three times Earth's mass. If these were accompanied by bodies as massive as Earth, the total mass would be comparable to the combined masses of Uranus and Neptune. But the higher estimates, of 10,000 or even 100,000 plutons, would imply amounts of mass and angular momentum that would be hard to reconcile with current models of planetary formation. One caveat should be kept in mind: the approach used to estimate the number of plutons — using relative velocities and collisional cross-sections — fails to explain the formation timescales of the outer planets, predicting that Uranus and Neptune would require more than the present age of the Solar System to accrete. Although this problem has long been recognized<sup>3</sup>, there is as yet no satisfactory solution. Presumably, some essential physics is missing from the cosmogonical models.

Although theory may be uncertain, there is still hope that observations can provide a definitive test. Where have the primordial plutons gone? Those that escaped collisions with the giant planets were removed from the region by gravitational scattering, sharing the same fate as the much smaller bodies that are comets. Some 10–50 per cent of these were scattered into distant orbits in the Oort cloud, some 10,000 astronomical units (AU) from the Sun (that is, 200 times further out than Pluto). There is unfortunately no way to detect objects at such distances. If the Oort cloud contains a thousand plutons, we may expect perturbations due to a nearby star to send a 1,000-km sized 'comet' into the

planetary system only once every 10 million years or so. Fortunately, we need not wait so long to see one. A consensus has developed that most of the short-period comets which we see in the inner Solar System are derived not from the Oort cloud, but from the Kuiper disk, a region beyond Neptune (30 AU) containing a population of comets having low orbital inclinations and moderate eccentricities<sup>8</sup>. In its original concept, the Kuiper disk was populated by bodies that formed *in situ* in the outer fringes of the solar nebula, where the density was too low to form planets. Recently, Torbett and Smoluchowski<sup>9</sup> showed that orbits in this region with perihelia less than about 45 AU (a little beyond Pluto) are chaotic, and diffuse under the influence of perturbations by the giant planets.

Their conclusions have been strengthened by Levison<sup>10</sup>, who used a mapping technique to model this diffusion over times comparable with the age of the Solar System, and shows that objects formed near Neptune's orbit can reach distances exceeding 100 AU. Thus, the Kuiper disk should be populated, at least

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### Count down

THERE are between 1.84 and 2.57 million species of insect on Earth, according to new estimates that differ markedly from claims that there are upwards of 10 million of them. These earlier estimates were based on extrapolations from the numbers of beetle species (Order Coleoptera) found on 19 specimens of a single tropical tree species, and are highly sensitive to assumptions about host-plant specificity. Fewer problems beset the sampling of an area of Sulawesi, Indonesia, reported by I. D. Hodkinson and C. Casson (*Biol. J. Linn. Soc.* **43**, 101–109; 1991): strategies ranging from collection by hand to canopy fumigation netted 1,690 species of bug (Order Hemiptera) over a one-year period, 1,056 of which were previously unknown. That the decline in new species collected as the year progressed lends reliability to the final total — as well as the extrapolated estimates of global insect species numbers.

### That's entertainment

Too much television is bad for you, they say, but in a remarkable case described by V. Ramani in *The New England Journal of Medicine* (**325**, 134–135; 1991), just one presenter causes problems. A 45-year-old woman suffered epileptic seizures triggered solely by the voice of Mary Hart, one of the hosts of the popular US TV programme *Entertainment Tonight*. The seizures were not triggered by background music or visual stimuli from the programme, different shows with similar formats, or other female voices. The patient's prognosis improved following drug treatment for blackout spells, and a strict avoidance of the show.

### Slimier slime

THE hagfish, or slime eel, when annoyed, discharges a cloud of mucus that can engulf the author of its displeasure. It achieves this through the lysis of gland cells, each of which throws out a single fibre, some 3  $\mu\text{m}$  thick and 60 cm long, made up largely of intermediate filaments (cytokeratins). E. A. Koch *et al.* (*J. struct. Biol.* **106**, 205–210; 1991) have now shown that these threads, with their parallel filament arrays, will further assemble into thick cable-like structures of striking appearance, very like those seen between hagfish eggs and responsible apparently for joining them into strings, like sausages. Koch *et al.* speculate that the mucus may tether the eggs to the spawning site, and note that the intimate details of the hagfish's sexual and reproductive mores are of some commercial interest — there are those who would like to breed the creatures, which are prized for the high quality of their 'eel-skin'.