

The invisible hand

Could a bizarre hidden planet be manipulating the solar system, asks Richard A. Lovett

THERE'S something odd going on in the solar system. Our once settled and peaceful home is looking increasingly disturbed and deranged. Bits of it are flying about in eccentric and inexplicable ways. Other bits seemingly shouldn't be there at all. Meanwhile, the sun is rotating at a rakish angle we are hard-pressed to explain.

Mike Brown, a planetary scientist at the California Institute of Technology in Pasadena, thinks he can explain these strange goings on. There is an unsettling influence in the room: something big and distinctly mobile. Not a poltergeist – but another planet.

It is a controversial claim that, if true, would revolutionise our view of the solar system and go some way to explaining why it looks so peculiar when compared with other solar systems. Brown and other proponents of “Planet Nine” say they now have enough clues to pin down its existence once and for all – or show we must seek another explanation for the solar system's eccentricities.

It wouldn't be the first time a planetary interloper had been unmasked in this way. Back in the 1840s, astronomers couldn't explain the wobbling orbit of Uranus, then the solar system's seventh and outermost planet. The French mathematician Urbain Le Verrier cracked the nut, suggesting the wobbles revealed a hitherto unseen eighth planet, and pinpointed where it must be. Just a few months later, astronomers found Neptune pretty much just at the right spot.

It's no sure-fire winner, mind: a decade or so later, Mercury had the collywobbles, and Le Verrier issued the same prescription. An unnoticed planet, dubbed Vulcan, was orbiting between Mercury and the sun and

disturbing the cosmic balance, he suggested. But Mercury's orbital oddity was eventually revealed to be down to something completely different, exposing flaws in the underlying theory of gravity that only Einstein's general theory of relativity would correct. Still, the principle remained: interesting things come to those who take note of planetary irregularities.

We have a few to take note of now. In 2006, Pluto was controversially declassified as a planet, largely because of the discovery of a swarm of other trans-Neptunian objects (TNOs) orbiting in the Kuiper belt beyond

HOW TO MAKE A PLANET

The International Astronomical Union's definition of a planet, adopted in 2006, controversially demoted Pluto to a dwarf planet. To be a fully blown planet, a solar-system body must now fulfil three criteria:

1. It must orbit the sun;
2. Its mass and gravity must be large enough to mould it into an almost round shape;
3. It must have cleared its surrounds of bodies other than those bound to it by direct gravitational influence (such as moons).

As just one of many “trans-Neptunian objects” orbiting in a similar space, Pluto fell foul of the third criterion. Planet Nine, if it exists, is almost certainly sufficiently larger than Pluto for none of the conditions to be a roadblock.

Neptune and even further out. One, Eris, was nearly as big as Pluto – although all are too puny to be full planets as now defined (see “How to make a planet”, below). And some of these objects follow truly bizarre paths. Take Sedna. This 1000-kilometre-wide body takes more than 11,000 years to revolve around the sun, and does so on a highly elliptical, or eccentric, trajectory. Where 1 astronomical unit, or AU, is Earth's distance from the sun, Sedna varies between 76 AU, about double Pluto's average distance, and a wild 940 AU.

Sedna and a handful of other “extreme” TNOs also orbit at distinct angles to the ecliptic, the plane around the sun's midriff on which all the major planets lie. There are other similarities in their orbits that are hard to explain with our current models of solar system dynamics.

Many explanations have been put forward for these oddballs. Some suggest, for example, that they are interlopers forced into the solar system by an interaction with a passing star (*New Scientist*, 8 June 2016, p 36). And in 2012, Rodney Gomes of the National Observatory in Rio de Janeiro proposed that they might be influenced by an as-yet undiscovered “planetary mass solar companion” lurking hundreds of AU out. Each time one of the extreme TNOs came close to it, its orbit would be altered, eventually causing them all to skew in a similar manner (see diagram, page 39).

Gomes didn't get much attention, but in 2014, Chadwick Trujillo of the Gemini Observatory in Hawaii and Scott Sheppard of the Carnegie Institution for Science in Washington DC published a similar argument in *Nature*. In January 2016, Brown and his Caltech colleague Konstantin Batyagin used ➤



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