provide a service for the scientific community and for the world in conveying rigorous, unbiased scientific information. One of the reasons these publications have this capacity is the credibility they have built up over decades. In science, credibility comes mainly from commitment to the scientific method. In politics, at least in democracies, it comes mostly from the ability to articulate why certain moral, ethical, economic or social trade-offs offer the best way to live. Scientific information can and should inform political discussions, by offering clarifying information about likely consequences of actions. But science is almost always insufficient to resolve deep and diverse moral and ethical debates about how we should live[9].

The current study provides evidence that, when a publication whose credibility comes from science decides to politicize its content, it can damage that credibility. If this decreased credibility, in turn, reduces the impact of scientific research published in the journal, people who would have benefited from the research are the worse for it. I read Zhang's work as signalling that *Nature* should avoid the temptation to politicize its pages. In doing so, the journal can continue to inform and enlighten as many people as possible.

That said, future research is needed to provide more-generalizable insights into the reputational risks associated with placing political endorsements in scientific publications. Experiments that examine the effects of various combinations of position-taking (the effects of endorsing a person or a policy, for instance) and situation (parliamentary systems or presidential systems of democracy) can provide greater clarity about when, if ever, a political endorsement advances the mission of a scientific publication.

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Astronomy

A compelling explanation for an enigmatic object

Marco Micheli

Seemingly contradictory observations of the first known interstellar object are reconciled in a model that presents a simple and physically realistic framework for understanding the object's many peculiarities. **See p.610**

The idea that an asteroid could pose a threat to Earth by colliding with it has prompted the development of telescopes dedicated to the discovery of asteroids and comets that range in size from metres to kilometres[1]. These telescopes often detect objects that pose no threat but are nonetheless scientifically intriguing. One such discovery was the first observation of a 'small body' originating outside the Solar System[2]. This object, known as 'Oumuamua, shows many irregularities in appearance and motion that have previously confounded astronomers[3]. But now, on page 610, Bergner and Seligman[4] present a model that explains most of the observed characteristics of 'Oumuamua without resorting to any exotic or unphysical mechanisms.

Interstellar objects have long been thought to transit our Solar System. Planetary systems eject large quantities of small bodies during the initial phases of their formation and, once ejected, these small 'planetesimals' travel through interstellar space for millions of years. It stands to reason that some of their paths will pass by the vicinity of the Sun. When 'Oumuamua was first discovered, astronomers

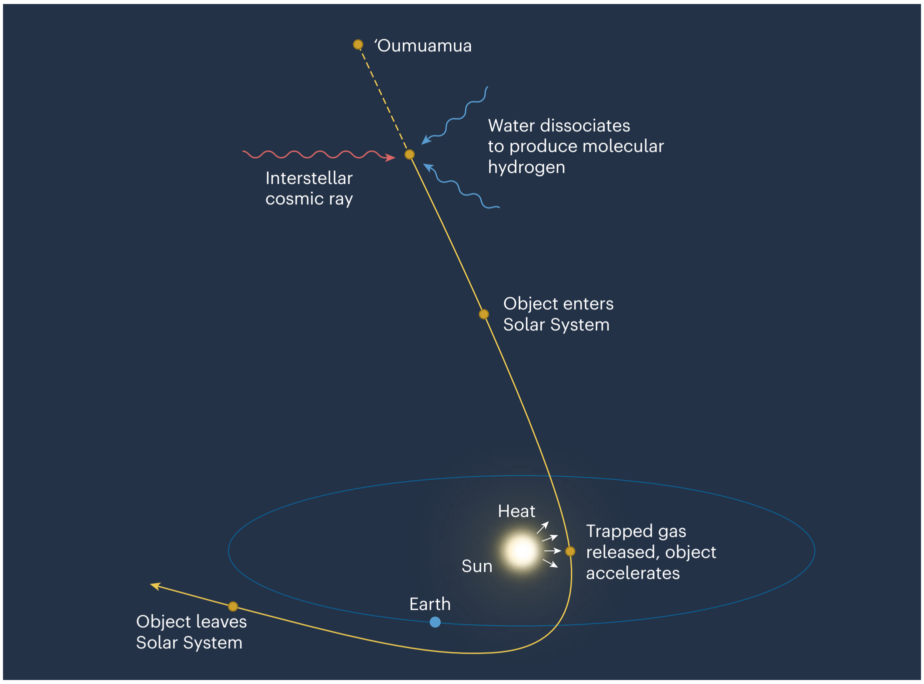

Figure 1 | A model for an unusual comet-like object. A small body called 'Oumuamua transited the Solar System and was observed for four months in 2017. It resembled an asteroid, but its acceleration was characteristic of a comet, leading astronomers to speculate about its composition and origin. Bergner and Seligman[4] present a model in which 'Oumuamua was born in another planetary system as a normal, water-rich comet. During its travel through interstellar space, it was irradiated by cosmic rays that dissociated its water to produce molecular hydrogen, which remained trapped in a water–ice matrix. The Sun then changed the crystalline structure of this ice and released the trapped gas, accelerating the object. The model is consistent with observations of 'Oumuamua, and suggests that similar objects could be found in our Solar System.

therefore expected it to behave like one of these fragments – not too dissimilar from the comets that form on the outskirts of our own Solar System.

From the beginning, however, something was amiss. ‘Oumuamua did not look like a comet and did not display the usual defining features of comets[2] – a tail and a fuzzy envelope called a coma, both made from gas and dust. Instead, it resembled an inactive object, like an asteroid, which moves mainly as a result of gravity. However, it soon became evident that the motion of ‘Oumuamua was not exclusively due to gravity: it was being pushed along its path in a similar way to that routinely observed in comets, which are subject to an acceleration caused by the recoil of emitted gas and dust. How was it possible that this object looked inactive, but was showing indirect evidence of activity?

‘Oumuamua was observed by most major observatories in the four months following its discovery, but after that, it quickly became too faint for even our most powerful telescopes. Astronomers were left with a large amount of data that needed to be tied together in a consistent model to describe the nature and composition of this unusual object. Such a model would have to reconcile the conflicting properties of ‘Oumuamua’s trajectory. Many models were proposed, some involving exotic compositions or origins[5]. Bergner and Seligman’s paper offers perhaps the first simple and physically realistic explanation of the peculiarities of this object (Fig. 1).

The authors’ basic idea echoes that of many previous attempts: it explains ‘Oumuamua’s acceleration as being a result of the object releasing gas from its surface – in this case, molecular hydrogen. But Bergner and Seligman’s innovation is in how they explain the existence of such hydrogen. They assert that ‘Oumuamua was born in its home planetary system as a normal, water-rich planetesimal, resembling a comet, and that it was constantly irradiated by galactic cosmic rays during its travel through interstellar space. The energetic particles in these rays caused the water molecules to dissociate and produce molecular hydrogen, which remained trapped in the water–ice matrix that makes up most of the object’s body. Then, when ‘Oumuamua approached the Sun, this ice changed its crystalline structure and released the trapped gas, propelling the object forwards.

Bergner and Seligman substantiate their claim by showing that there is enough ice under ‘Oumuamua’s surface – and that it can get hot enough – to release the hydrogen gas necessary to explain the observed acceleration. More importantly, their model does not require an amount of hydrogen that would be visible to astronomers on Earth, nor does it require the same of water, which might also be emitted by such a water-rich body. This explains how ‘Oumuamua could have seemed inactive while emitting enough hydrogen to push it around.

The authors’ proposal is compatible with our current understanding of how interstellar objects form, and doesn’t assume that they contain any exotic material that is not present in comets that originate in the Solar System. At the same time, the idea that these foreign objects closely resemble our own comets leads to an obvious question: why don’t we see similar non-gravitational forces acting on the thousands of comets we’ve observed so far in our Solar System?

Bergner and Seligman’s explanation for this is simple: the mechanism they describe is a surface effect, in that heat from the Sun penetrates only a small layer close to the surface of the object. This means that, the larger the object, the less dominant the effect becomes. With a diameter of roughly 100 metres, ‘Oumuamua is much smaller than normal comets, which are usually a few kilometres in size, so the surface effect is more pronounced in ‘Oumuamua that it is in most observed comets.

If the authors’ model is correct, however, we should expect the effects of their mechanism to be observed in comets that are similar in size to ‘Oumuamua, but that originate in our own Solar System. We haven’t yet spotted such objects, but the hope is that future telescopes will find them, and that instruments such as the James Webb Space Telescope will help us to investigate them in detail. Such discoveries would be welcome, given that ‘Oumuamua is no longer observable. And, now that we know what to look for, we are a step closer to the key observations that can conclusively prove whether we finally understand the nature of this fascinating object.

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Synthetic biology

An antiviral molecular language barrier

Benjamin A. Blount

Bacteria with a synthetic genome were engineered to alter the way that the DNA code instructs cells to make proteins. This ‘language barrier’ serves to isolate the cells genetically, and makes them immune to viral infection. **See p.720**

As scientists gain an increasing ability to build synthetic genomes to specific design criteria, this is enabling the production of cells that have beneficial properties not found in the natural world. Nyerges *et al.*[1] report on page 720 that they have engineered bacteria to be immune to viral infections and to acquire properties that could be useful for microbial biocontainment. The work has implications for the development of safe and efficient applications in biotechnology, and is a compelling demonstration of the possibilities that are opened up by the use of synthetic genomes.

Unlike genome-engineering techniques in which an existing genome in living cells is modified, synthetic genomes can be designed and built from scratch. This means that the scale of changes to a genome, and consequently to a cell’s behaviour, is no longer limited by the ability to edit existing DNA.

A functioning synthetic genome has previously been built[2] for the model bacterium *Escherichia coli*. A feature of this genome is a change to how the bacterium translates the information encoded by its DNA into proteins.

DNA determines the order and content of amino acids in a protein, and sequences of three DNA bases, termed codons, encode a given amino acid. This code is almost universally evolutionarily conserved across biology. To produce a protein, DNA-sequence information is copied into a corresponding messenger RNA. A transfer RNA (tRNA) recognizes each codon and then ‘translates’ it into a specific amino acid to be incorporated into a growing protein chain. There is redundancy