NATURE

50 Years Ago

At the International Geological Congress in Copenhagen in 1960, and at the Russian Trade Exhibition in London last year, one of the outstanding scientific exhibits was a hand-coloured tectonic map of Europe compiled by Russian draughtsmen from copy submitted by the various national geological surveys. The map, on a scale of 1:2,500,000, has been sponsored by the Sub-Commission on the Tectonic Map of the World of the International Geological Congress … Western geologists who wish to make sure of receiving a copy should place an order, in advance of publication, with their national agents for Russian books.
From *Nature* 20 January 1962

100 Years Ago

The possibility of the discovery of a remedy for cancer has been advanced a stage by the preparation by Prof. Wassermann, of Berlin, of a substance which possesses a curative action experimentally on cancer of mice. Prof. Wassermann reasoned that since the cancer-cells are growing rapidly, their oxygen requirements would be different from, and greater than, those of the cells of the body generally. He sought for some substance which might interfere with the oxygen supply to the cancer-cells, and finally adopted selenium as a means to do this. The next problem was to convey selenium to the cancer-cells by means of the blood stream, and … a compound of selenium with an anilin dye eosin was found to fulfil this condition … After two or three injections of the substance into a mouse the subject of cancerous tumours, the tumours are found to have softened, and after six to eight doses they become cystic, diminish in size, and finally disappear, and no recurrence takes place. The eosin–selenium compound is, however, poisonous, and a certain number of mice succumb under the treatment.
From *Nature* 18 January 1912

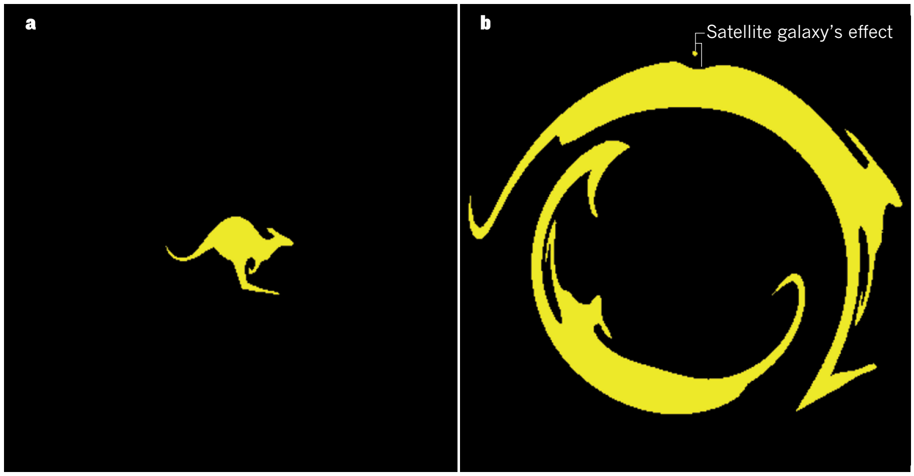

Figure 1 | Seeking satellites. Vegetti *et al.*[4] have discovered a satellite galaxy around a larger galaxy, located at a cosmological distance, by examining how both galaxies act as gravitational lenses and distort light from a background source as the light travels to Earth. **a**, Were there no lenses between an observer on Earth and a source — here illustrated as a kangaroo[10] — the observer would, if instrumentation allowed, see one image of the source. **b**, If there is a massive lens between the observer and the source, the source is magnified and imaged more than once. In this case, as in the authors' study, the source is deformed into a ring that consists mainly of two distorted images of the source. The two images are caused by the larger galaxy, whereas the dent and blob features (labelled) are caused by the satellite galaxy, the mass of which has been exaggerated to demonstrate the effect more clearly.

In the present study, the gravitational lens system, called JVAS B1938+666, consists of a very distant galaxy that bends light from an even more distant background galaxy. Light from the background galaxy is deformed into a ring around the lens galaxy — a prime example of what is known as an Einstein ring. In this case, the ring is formed mainly by two lensed images of the background galaxy[5].

Vegetti and her team[4] obtained a near-infrared image of JVAS B1938+666 using the 10-metre Keck telescope in Hawaii. They used an optics system that corrects for the blurring effect of Earth's atmosphere to improve the image quality. With such data, they could neatly determine the mass distribution of the lens galaxy, as well as the shape and brightness of the background galaxy.

And here comes the connection to satellite galaxies. The sophisticated numerical technique[6] used by the authors allowed them not only to derive a model of the lens galaxy's mass, but also to map any excess lens mass that could not be accounted for by the galaxy. They found an excess mass near the Einstein ring that they attributed to the presence of a satellite galaxy (Fig. 1). This method has been dubbed gravitational imaging[6]. Vegetti *et al.* also used an analytical model to test the detected excess mass and found that a satellite galaxy is indeed required to explain the data.

This satellite galaxy is exciting because it was detected in the excess-mass map despite its low mass. Assuming that the object is in the neighbourhood of the main lens galaxy, it has a mass of some 113 million solar masses within a radius of about 600 parsecs (2,000 light years) — values that put it firmly in the realm of satellite galaxies. The mass is tenfold lower than those of two other satellite galaxies that have been detected[7,8] recently using gravitational lenses (with the possible exception of another low-mass satellite[8], although the detection of this object is not yet confirmed).

Vegetti and colleagues[4] went on to determine the mass function of satellite galaxies — that is, the expected number of satellites for a given mass — at distances beyond the local Universe by combining data from the new object and another satellite galaxy[7]. They found that the resulting mass function is consistent with current galaxy-formation theory. But owing to the small number of known objects, uncertainties in the deduced function are quite large.

A natural question to ask is whether the satellite galaxy can be observed directly rather than by its gravitational effect on the shape of a background object. With current instrumentation, the answer is no. The object is simply too distant to be imaged directly. But the message here[4] is that it is possible to spot these elusive objects around distant lens galaxies without knowing where to look for them.

The satellite should be considered in the context of about 50 satellite galaxies that are known to exist in the Local Group and that have been found by imaging their starlight[3,9]. The number of these nearby satellites has greatly increased over the past decade, and often only a hundred (or fewer) stars are detected in them. From measurements of the velocities of their member stars, the satellites have been shown to be dominated by an unseen mass component called dark matter. Dark matter is the reason that satellites such as the newly discovered one are massive enough to be found using gravitational lenses.