who became infected during the recent outbreak escaped detection. Miles Carroll, an epidemiologist at Public Health England in Porton Down, and his colleagues tracked 80 people who had contact with Ebola patients in Guinea but did not themselves become noticeably ill. Yet 15–20% of these contacts developed immune responses capable of neutralizing Ebola viruses, suggesting that they had contracted mild infections that went undetected.

This 'sub-symptomatic' or 'asymptomatic' Ebola was known to exist, but the latest studies involve more people who have been studied more intensively than in the past. Researchers caution, however, that it is still rare for Ebola lingering in a person's body to spark new outbreaks. The phenomenon would probably have escaped notice if the recent epidemic had been smaller.

Thousands of men who are infected have survived, but until recently scientists did not know that the Ebola virus could be transmitted in semen beyond three months, says Mary Choi, an epidemiologist at the US Centers for Disease Control and Prevention. The agency and the Liberian government are running the largest-ever investigation of Ebola viruses in the semen of survivors. So far, the team's study of 466 men has detected virus fragments in semen up to 18 months after a man has recovered from his infection[1].

In February, two months after the outbreak was declared over in Guinea, Duraffour and her colleagues traced a cluster of new Ebola cases to a man who transmitted the virus to a sexual partner 17 months after recovering from his infection[2]. Yet another study, which examined 26 male Ebola survivors, found that the vast majority eliminated the virus from their semen within 4 months of recovery[3]. The precise timing varied widely from person to person, however.

Choi says that the virus probably lasts for longer than 18 months in semen. Her team will continue to monitor the virus's persistence, while counselling survivors to use condoms or abstain from sex until their semen tests negative twice. "The primary takeaway is that semen testing should be incorporated earlier on as part of services that survivors receive," Choi says.

Researchers must show sensitivity in communicating such findings, says virologist Stephan Günther of the Bernhard Nocht Institute, and take care not to make life more difficult than it already is for Ebola survivors, who face discrimination and lingering health problems. "We have to be careful to stress that these are very, very rare events." ■


1. Soka, M. J. *et al. Lancet Glob. Health* http://dx.doi.org/10.1016/S2214-109X(16)30175-9 (2016).
2. Diallo, B. *et al. Clin. Infect. Dis.* http://dx.doi.org/10.1093/cid/ciw601 (2016).
3. Sissoko, D. *et al. Lancet Glob. Health* (in the press).


The Gaia telescope's data will help to measure the distances to 'standard candles' such as RS Pup (centre).

GAIA SPACECRAFT

# Galaxy map will change astronomy

*Data will shed light on exoplanets, cosmology and more.*

BY DAVIDE CASTELVECCHI

Astronomers the world over are about to get their first taste of a transformative tool. As *Nature* went to press, Gaia, a space telescope launched by the European Space Agency (ESA), was due to release its first map of the Milky Way on 14 September. Initially, the catalogue will show the 3D positions of 2,057,050 stars and other objects, and how they have changed over two decades. Eventually, it will contain one billion objects or more.

The release is expected to include 19 papers by the Gaia astronomers who have seen the data. Independent teams could produce 100 or so papers just in the weeks following the release of the draft catalogue, says Lennart Lindegren, an astronomer at the Lund Observatory in Sweden and a driving force for Gaia.

"Gaia is going to revolutionize what we know about stars and the Galaxy," says David Hogg, an astronomer at New York University. He and others are leading 'Gaia hacking' events that will attempt to exploit the burst of data. So, what might some of the discoveries be?

## MILKY WAY ARCHAEOLOGY

Gaia's 3D view will reveal how stars move under the Milky Way's combined gravitational pull. This will add to knowledge of the Galaxy's structure, including that of parts not directly visible from Earth, such as the 'bars' that join the Galactic Centre to the Milky Way's spiral arms.

Researchers will also be able to identify outlying stars that stream together at high speeds and are thought to be remnants of mergers with smaller galaxies, says Michael Perryman, a former senior scientist for Gaia at ESA. Combined with data about stars' colour, temperature and chemical composition, this will enable researchers to reconstruct the Galaxy's 'archaeology' from the past 13 billion years.

## WHERE IS THE GALAXY'S DARK MATTER?

The details of star trajectories will uncover the Milky Way's distribution of dark matter, which constitutes the bulk of matter in the Universe. That could help to reveal what dark matter is.

Gaia might also put some exotic theories to the test. MOND (modified Newtonian dynamics) predicts a different Galactic gravitational field from standard dark-matter theory; star

NASA

velocities measured by Gaia will be able to investigate which is right. The probe might even help to reveal whether dark matter killed the dinosaurs, as suggested by a theory from 2013.

### DISPUTED STELLAR DISTANCES

Gaia will provide precise measurements of how far individual stars lie from the Sun.

One of the first groups of stars that researchers want to check is the Pleiades, a cluster in the constellation Taurus. Most observations, including one made with the Hubble Space Telescope, put the cluster about 135 parsecs (440 light years) away (D. R. Soderblom *et al. Astron. J.* **129,** 1616–1624; 2005). But results based on data from Hipparcos, an ESA space mission that preceded Gaia, suggest that it is only 120 parsecs away (F. Van Leeuwen *Astron. Astrophys.* **497,** 209–242; 2009).

The discrepancy cast some doubt on the Hipparcos result. Gaia uses a method that is similar to, but much more evolved than, that of the earlier mission, so astronomers will be watching it closely.

### NEW WORLDS

Astronomers have discovered thousands of planets orbiting other stars, mostly by detecting tiny dips in a star's brightness when an orbiting planet passes in front of it. Gaia will instead seek planets by looking for slight wobbles in the star's position caused by a planet's gravitational pull.

Gaia's technique is best suited to detecting large planets in relatively wide orbits, says Alessandro Sozzetti, a Gaia researcher at the Astrophysical Observatory of Turin in Italy. And unlike the more common transit method, it directly measures a planet's mass. If it works, it will be a striking comeback for a technique that has seen many false starts. But it will require several years of observation, with a sneak preview expected by 2018, Sozzetti says.

### HOW FAST IS THE UNIVERSE EXPANDING?

Gaia explores the Milky Way, but its influence extends to the wider observable Universe.

To estimate the distances to faraway galaxies, astronomers typically use stellar explosions called Type Ia supernovae. The explosions' apparent brightnesses reveal how far away they and their galaxies are. Such 'standard candles' have been the main tool for estimating the rate of expansion of the Universe, and have led astronomers to propose that a mysterious 'dark energy' is accelerating the expansion.

The method depends on a comparison with other types of standard candle in the Milky Way. In its first release, Gaia will measure the distances to thousands of such stars. Such measurements may eventually resolve conflicting estimates of the rate of cosmic expansion.

### INVISIBLE ASTEROID THREATS

As it scans the sky, Gaia is expected to discover hundreds of asteroids inside the Solar System, says Gaia astronomer Paolo Tanga of the Côte d'Azur Observatory in Nice, France.

When it spots a near-Earth object, an asteroid whose orbit brings it within about 200 million kilometres of Earth, Gaia can alert observatories to use ground-based telescopes to establish whether the object is a threat.

It will scan nearly the entire sky and might reveal objects that, during certain times, are too close to the Sun to observe from Earth, says Anthony Brown, an astronomer at the Leiden Observatory in the Netherlands and chair of Gaia's data-processing collaboration. Asteroid paths will also enable Gaia to perform sensitive tests of the general theory of relativity. ■

**Read a longer version at go.nature.com/2cy81uy**

### CORRECTION

The News story 'Mars contamination fear could divert Curiosity rover' (*Nature* **537,** 145–146; 2016) should have made it clear that the dark streaks near Curiosity are only 'potential' recurring slope lineae. And it should have said that the Murray formation — not the Murray Buttes — was formed from ancient lake sediments.