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SPACE

'TSUNAMI-LIKE' STARQUAKES AMONG THE DISCOVERIES IN THE MOST DETAILED SURVEY OF THE MILKY WAY EVER

The European Space Agency's Gaia spacecraft's latest data release has revealed a treasure trove of insights about our home galaxy

Since its launch in 2013, the spacecraft has been on a mission to create the most accurate multidimensional map of the Milky Way ever. Now, with its third data release, Gaia has published a raft of new findings based on observations of almost two billion stars and other cosmological bodies.

"Unlike other missions that target specific objects, Gaia is a survey mission. This means that while surveying the entire sky with billions of stars multiple times, Gaia is bound to make discoveries that other more dedicated missions would miss," said Gaia scientist Timo Prusti.

"This is one of its strengths, and we can't wait for the astronomy community to dive into our new data to find out even more about our galaxy and its surroundings than we could've imagined."

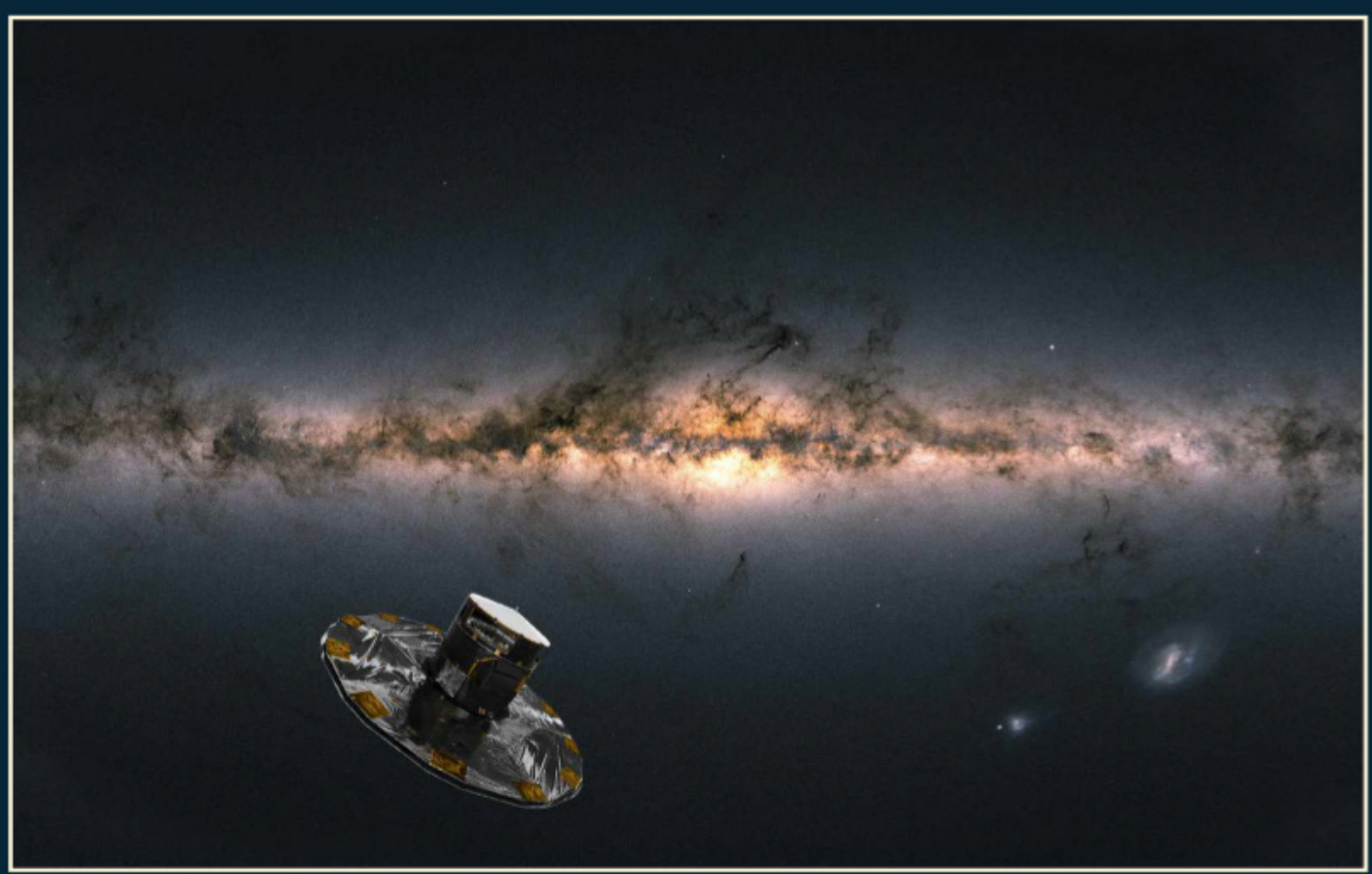
STARQUAKES

One of the headline observations in the latest release is of unusual oscillations, known as starquakes, that ripple along the surface of stars – something Gaia was never originally designed to detect.

Starquakes occur in magnetars – a type of small, dense neutron star with some of the strongest magnetic fields in the Universe. These magnetic fields cause huge stresses in the stars' crusts, which produce rippling earthquake-like effects.

Gaia had previously observed starquakes with radial oscillations that cause stars to swell and shrink periodically, while maintaining their spherical shape. The newly spotted starquakes move across the surface like giant tsunamis, however, making them trickier to spot. But these unusual and unfamiliar starquakes are of great interest to astronomers, so they're keen to catch sight of more of them.

"Starquakes teach us a lot about stars, notably their internal workings. Gaia is opening a goldmine for 'asteroseismology' of massive stars," said Gaia scientist Conny Aerts of KU Leuven in Belgium.



An artist's impression of ESA's Gaia satellite during its mission to survey the Milky Way. The background shows the total brightness and colour of over 1.8 billion stars seen by Gaia, details of which were disclosed in its third data release

ESA/D DUCROS, ESA X2

STELLAR 'DNA'

Gaia's latest release contains detailed information on almost two billion stars, including their temperatures, ages and chemical compositions.

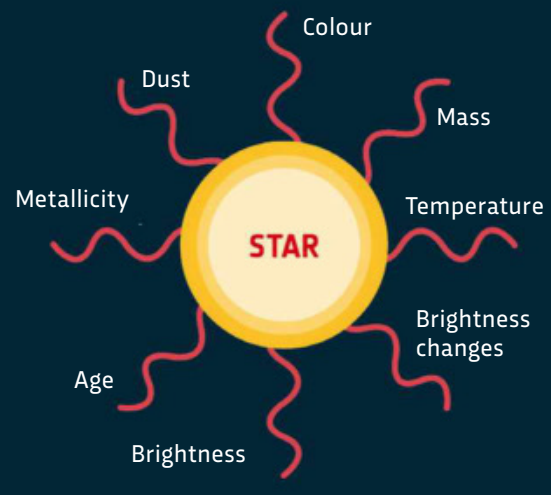
Astronomers can learn a lot about stars by studying their chemical compositions, which, similar to DNA, provides clues as to their origins and lifecycles. A star's chemical composition can be determined through spectroscopy – a technique that analyses the light a star produces to figure out what chemicals are present inside it.

Data from Gaia shows that some stars in the Milky Way are made from primordial material while others, such as the Sun, are composed of material made in previous generations of stars.

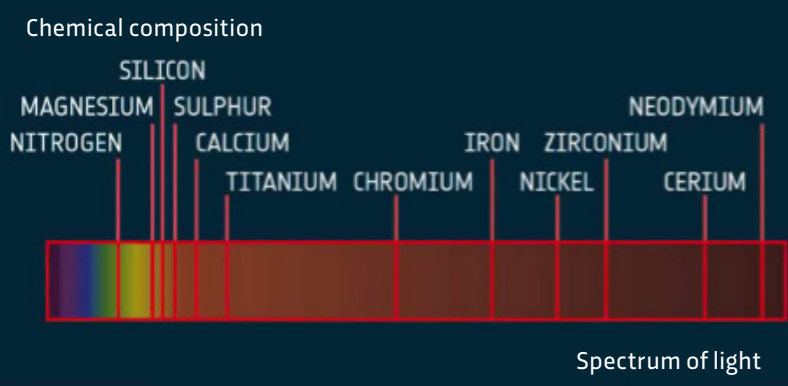
The early Universe consisted mainly of light elements, such as hydrogen and helium. The heavy elements were created in stars that formed later, as the lighter elements collapsed under gravity. When stars die, they release these heavier elements, which go on to form new stars – essentially seeding their 'DNA' into successive generations.

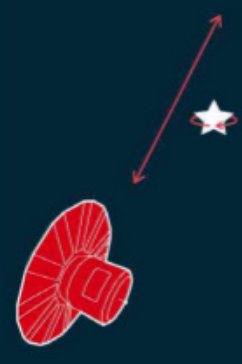
"Our galaxy is a beautiful melting pot of stars," said Gaia scientist Alejandra Recio-Blanco of the Observatoire de la Côte d'Azur in France. "This diversity is extremely important, because it tells us the story of our galaxy's formation. It reveals the processes of migration in our galaxy and accretion from external galaxies. It also clearly shows that our Sun, and we, all belong to an ever-changing system, formed thanks to the assembly of stars and gases of different origins."

TECHNIQUES TO STUDY STARS IN THE MILKY WAY



PHOTOMETRY



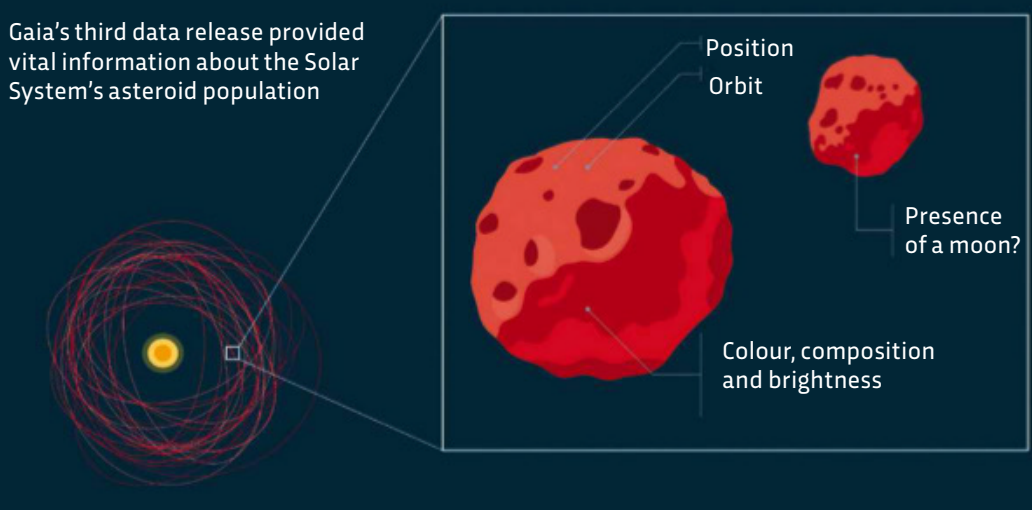


Radial velocity – the speed a star moves towards or away from us

Rotational velocity – the speed a star rotates around its axis

SPECTROSCOPY

Gaia's third data release provided vital information about the Solar System's asteroid population



156,000 asteroids catalogued

ASTEROIDS

The Gaia scientists have also used the new data to compile a catalogue of more than 156,000 asteroids. It's the most accurate catalogue of asteroids ever composed and contains information about their orbits and compositions.

The asteroids observed by Gaia include the main-belt asteroids; Trojan asteroids that orbit Jupiter; 24 members of the asteroids found in orbit beyond Neptune; and asteroids pulled into the centre of the Solar System due to gravitational attraction of various planets, which includes so-called near-Earth objects (NEOs). None of the currently known NEOs are in danger of striking Earth in the coming decades, Gaia researchers say.