A star is born

Tapping, Ken

Publisher's version / Version de l'éditeur:
https://doi.org/10.4224/21277538
Skygazing: Astronomy through the seasons, 2013-09-03

A STAR IS BORN

Ken Tapping, 3rd September, 2013

The astronomical community has been eagerly following a recent birth announcement. For the first time, we have been able to observe the birth of a new star. This discovery comes from having the right instrument and happening to be looking in the right direction at the right time.

Stars live a lot longer than we do. Giant stars last a few million years before blowing up, middle-sized stars like the Sun can last some ten billion years or so, and dwarf stars can last much longer, possibly longer than the expected life of the universe. Since we have only been doing astronomy for a few thousand years, we have not managed to observe any star over a meaningful part of its life cycle. We have learned what we have through looking at lots and lots of examples, of stars of many types and brightnesses, and with the help of physics and a lot of hard work, put together what we currently believe to be the life cycle of a star.

Stars form from the collapse of clouds of dust and gas. When the temperature and density in the core of the collapsing cloud get high enough, nuclear fusion starts up and the star starts to shine. The radiation from the newborn star blasts away the most of the remaining cloud material and as the cloud disperses the star becomes visible to us.

During its "life" the star obtains energy by converting hydrogen into other elements. Eventually it starts to run out of fuel. What happens thereafter depends on how much cloud material the star collected before it lit up. High mass stars become hot, blue giants that radiate energy at a tremendous rate and then, when they start to run out of fuel, blow themselves up in huge explosions known as supernovae. Less massive stars, like the Sun, swell up and sneeze off their outer layers, leaving a hot core, devoid of fuel, known as a white dwarf star. Low-mass stars smoulder on more or less indefinitely. These sneezes and explosions advertise themselves well in the sky, so when they occur they soon get detected and become the target of many astronomical instruments. However, the beginning of a star is another issue altogether. We have found lots of clouds with stars forming inside them, clouds with young stars in them, and young stars that have blown their birth clouds away. However, we had not been able to find a real newborn star, until a couple of weeks ago.

A major reason for this discovery is having the right instrument. In this case it was a new radio telescope, located on the Atacama Plateau in Chile, and called ALMA, which is short for the Atacama Large Millimetre Array. It is a cluster of precision antennas that work together to produce high-quality images. At millimetre wavelengths, the Earth's atmosphere is a problem, especially the water vapour it contains, hence the location of the telescope on a high, dry plateau.

What ALMA detected are jets of carbon monoxide being blasted away at between one and two million kilometres an hour and whirling clouds of material being hit by the radiation from the newborn star. This event is taking place about 1,400 light years away, in the constellation of Vela (a light year is the distance light travels in a year, which is just under 10,000,000,000,000 km). Vela ("The Sails") is one of the constellations set up when the super-constellation of Argo Navis (the ship used by Jason and the Argonauts) was subdivided into more manageable star groupings.

Like many other major new astronomical instruments ALMA is operated by an international consortium, of which Canada is a member. So far our contribution has included operation and management personnel and cutting edge radio telescope electronics and other equipment.

Venus and Saturn lie low in the west after sunset. Jupiter rises about 2am and Mars about 4am. The Moon will be New on the 5th.

Ken Tapping is an astronomer with the National Research Council's Dominion Radio Astrophysical Observatory, Penticton, BC, V2A 6J9.

Tel (250) 497-2300, Fax (250) 497-2355

E-mail: ken.tapping@nrc-cnrc.gc.ca