Crucial astronomy finding announced by Academia Sinica - Taipei Times

GROWING PAINS:The researchers said they think that a major part of baby stars' growth comes via 'FU Orionis outbursts,' not a steady gain in mass

By Chen Wei-han / Staff reporter

Academia Sinica yesterday announced what it called a revolutionary astronomical finding: that young stars might gain mass through a series of violent episodes, not through a steady accumulation, as previously believed.

An international research team led by Academia Sinica researchers Hauyu Baobab Liu (呂浩宇) and Michihiro Takami of the Institute of Astronomy and Astrophysics, found complex structures around four newborn stars that might be related to sudden and violent "feeding" events.

The events manifest themselves as sharp stellar brightening, characterized by a fast and dramatic increase of mass and luminosity by a factor of at least 100, he said.

"These phenomena are called 'FU Orionis outbursts,' as they were first discovered toward the star FU Orionis. Not so many stars have been found to be associated with such outbursts — only a dozen out of thousands — but our team speculates that all baby stars may experience such outbursts as major part of their growth," Liu said.

Astronomers have long assumed that the formation of stars and solar-like systems follows a rather smooth and steady evolution paradigm: protostellar mass accumulate and concentrate toward the center to form a young stellar object and protoplanetary disk at a stable rate due to gravitational pull, Liu said.

However, the observed steady and continuous accretion can actually only explain a small fraction (between 1 and 10 percent) of the final mass of a newborn star, leaving astronomers to ponder how the rest of the mass is formed, he said.

Using a specialized telescope, the team captured images for the first time of the complex structures around four newborn stars, with the protostars showing asymmetrical disc structures, such as large-scale spiral arms and arcs and massive fragments, suggesting that the protostars and protoplanetary disks might experience an extremely chaotic evolutionary process, rather than a smooth, continuous growth, Liu said.

Most of the time the protostars hardly accumulated any mass, and then episodic accretion was observed when dense clumps of materials suddenly collided into the center, which rapidly increased the mass and luminosity of the stars and destabilized their disks, leading to the formation of spiral arms and fragments, he said.

“We postulate that the planet-disk interaction and multiple gravitational perturbations could trigger FU-Orionis outbursts, while star and planet formation undergoes tempestuous growth episodes,” he said.

The theory may also explain the presence of exoplanets that are found extremely far away from the central star, sometimes at more than 1,000 times the distance between the Sun and the Earth, as gravitational perturbation and interaction could fling massive gaseous clumps away from the central star, and the clumps later become gas giant planets, he said.

The team’s findings were published in the Feb. 5 edition of the journal Science Advances.