Formation and large scale confinement of jets emitted by young stars finally elucidated

16 October 2014

Credit: INRS

An international team of scientists has succeeded in explaining the formation and propagation over astronomical distances of jets of matter emitted by young stars—one of the most fascinating mysteries of modern astronomy. Using a patented experimental device and large-scale numerical simulations, the team obtained data consistent with astrophysical observations. The results of this research—just published in the prestigious journal *Science*—open up new opportunities for studying the role of magnetic fields in astrophysics and thermonuclear fusion. Bruno Albertazzi, a doctoral student in the energy and materials sciences program at INRS (in co-supervision with Ecole Polytechnique en France), is the primary author.

The team of scientists from France, Canada, Italy, Germany, the United Kingdom, Russia, Japan, and the United States demonstrated that stellar jets can be confined by a large-scale magnetic field aligned with their axis. "Not only is it consistent with current astrophysics data, the proposed mechanism helps explain intriguing X-ray emissions that have been observed along the jets by the Chandra space telescope," explains INRS professor emeritus Henri Pépin, who took part in the research. "This same mechanism could be at play in other types of astrophysical jets like white dwarfs, neutron stars, and black holes."

As part of the project, the scientists developed a model of the interstellar magnetic field in order to study the plasma jets of emerging stars. They were able to simulate this phenomenon in the lab for the first time using an experimental platform combining high intensity lasers and intense magnetic fields. After producing a plasma at a small scale typical of the atmosphere of young stars, the researchers generated a magnetic field representative of the interstellar environment inside a few cubic centimetres for a few millionths of a second. Supercomputers were then used to model emerging young stars as well as the laboratory experiment. These simulations confirm the key role of interstellar magnetic fields in creating, accelerating, and directing the jets that travel astronomical distances.

More information: *Science* DOI: 10.1126/science.1259694

Provided by INRS