Astronomers investigate star-forming processes in the young stellar object G29.862–0.044

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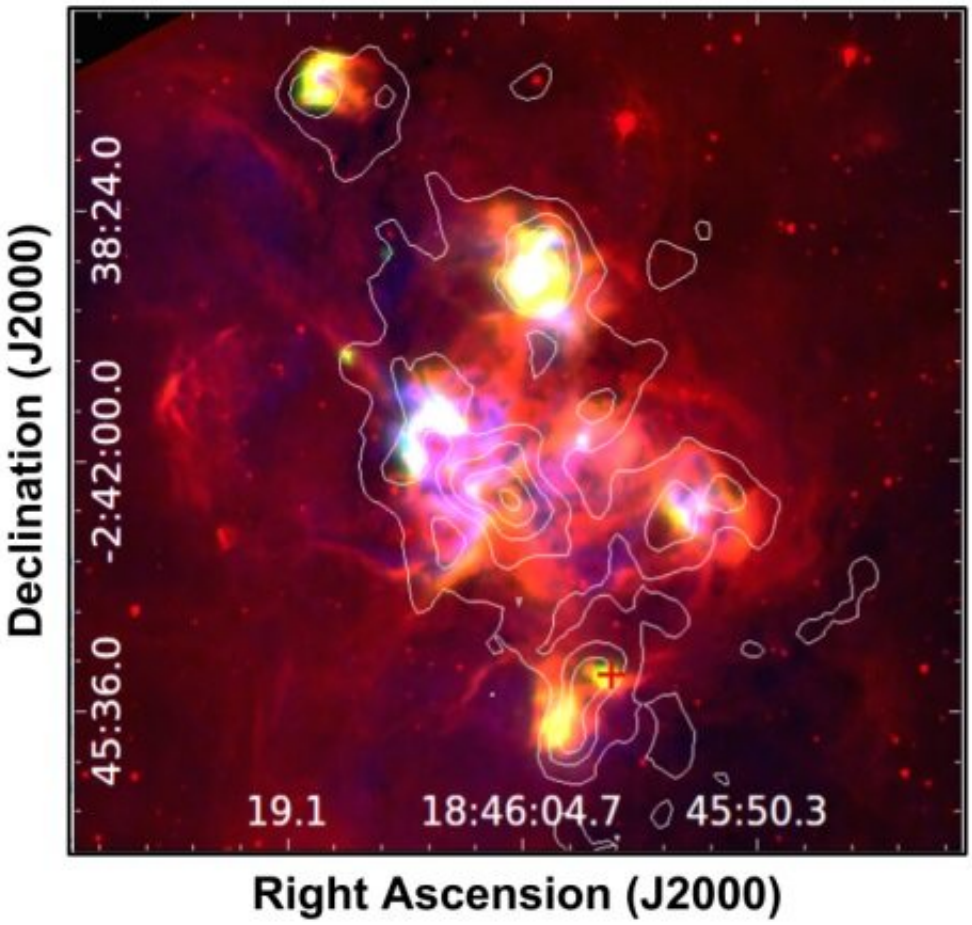

Three-color image towards G29.96–0.02. The YSO position is indicated with the red cross. Credit: Areal et al., 2019.

Astronomers have conducted a multiwavelength study of a young stellar object (YSO) known as G29.862–0.044, which provides more hints into star-forming processes. Results of the study, presented in a paper published April 24 on arXiv.org, could be important for improving our general knowledge about how stars form and evolve.

YSOs are stars in early stage of evolution, in particular protostars and pre-main sequence stars. They are usually observed embedded in dense molecular clumps, environments containing plenty of molecular gas and interstellar dust.

Located some 21,000 light years away from the Earth, G29.862–0.044 (or G29 for short) is embedded in the massive star-forming region G29.96–0.02. This YSO was a target of multiwavelength observations performed by a team of astronomers led by María Belén Areal of University of Buenos Aires, Argentina. They used the 15-m James Clerk Maxwell Telescope and Gemini-North 8.2-m telescope to study G29 and its environment in order to obtain a complete picture of this YSO, the related star-forming processes, and the interstellar medium around it.

"In the present work, we focus on the study of the southern massive YSO cataloged as the Red MSX source G029.862–0.044 (hereafter G29). (...) The surrounding interstellar medium of G29 is studied using molecular lines data. (...) The physical conditions of G29 molecular outflows and the clump where the YSO is embedded are characterized," the astronomers wrote in the paper.

The observations allowed the astronomers to detect molecular outflow in G29, what is typical for YSOs at the earliest stages of formation. In particular, they found a red molecular outflow, but they were not able to distinguish any blue molecular outflows. This is most likely due to the presence of a dense concentration of cold dust southwards of this YSO as such feature could hide the blue outflows.

The researchers also estimated physical parameters of the red molecular outflow, obtaining a mass of around 82 solar masses and an energy of approximately 20 quattuordecillion erg. According to the paper, these values are characteristic for molecular outflows.

Moreover, the scientists characterized the molecular cloud in which G29 is embedded in, unveiling its morphology and calculating its mass. They estimate that mass of the cloud is at a level of some 10,000 solar masses.

Furthermore, studying G29's surroundings, the team found that the emission in the Ks-band towards this YSO showcases a cone-like feature pointing to the northwest in direction to the red molecular outflow. This feature was observed to have two arc-like structures, similar to what was found in massive YSOs with precessing jets.

The authors of the paper concluded that the detected near-infrared emission at the Ks-band towards G29 most likely arises from a cavity cleared in the circumstellar material by the action of a jet. They added that this emission may be in fact due to a combination of various emitting processes.

"Further investigation is needed in order to determine such processes. We are currently analyzing in detail the near-IR data set (the JHKs broadbands and specially the emission lines observed with the narrow-bands), which will provide valuable information about the origin and physical processes taking place in this intriguing structure," the researchers wrote.

More information: M. B. Areal. Studying star-forming processes towards G29.862-0.044. arXiv:1904.10914 [astro-ph.GA]. arxiv.org/abs/1904.10914