Mystery of Star Formation Revealed by Hearts of Molecular Clouds

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Normal pathway to star formation

Diffuse gas shrinks into denser gas concentrations, called “molecular clouds”. Molecular clouds have dense cores surrounded by gas envelope, where stars form.
Star formation at the far outskirts of galaxies

It was a surprise to find young stars in galaxy outskirts by NASA’s GALEX satellite. And their formation sites have remained a mystery since then.
Discovery of molecular clouds at the far outskirts
For the first time, the parental star formation sites were revealed with ALMA.
Discovery of molecular clouds with invisible envelopes

But what we see are the “hearts” of the parental star formation sites.
Large atomic gas reservoir & inefficient conversion to molecular clouds

Atomic to molecular gas conversion is the next mystery.
Utilized World’s Largest Telescopes
This research used observations from many telescopes.

Diffuse (atomic) gas

Molecular clouds

New Mystery

Discovered
Dense gas core
“Hearts” of clouds

Young Stars

VLA

GBT

ALMA

GALEX

Subaru telescope
International Collaboration

United States (present at this AAS meeting)
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• Yutaka Komiyama – Hosei University
• Kana Morokuma-Matsui – University of Tokyo
Summary

For the first time, the parental star formation sites at the far outskirts of galaxies were revealed with ALMA. Atomic to molecular gas conversion is the next mystery.