Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)


PEM34-08 Room:503 Time:May 1 15:00-15:15

# Magnetohydrodynamic Simulations of the Interaction of a Jet with Interstellar Neutral Hydrogen Clumps

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An astrophysical jet transfers the energy released near the gravitating object and interact with the interstellar medium. When the jet propagates in the interstellar medium interacting with its environment. We carried out magnetohydrodynamic simulations of the jet propagation in neutral hydrogen (HI) clumps taking into account the interstellar cooling. At the initial state, HI clumps are assumed to be in thermal equilibrium. As the clumps are compressed by the bow shock ahead of the jet, the shocked cloud is heated up but since the density enhancement increases cooling rate, the cloud is subsequently cooled down. As a result, cold, dense sheath is formed around the jet. The enhanced density triggers the cooling instability and prompts the formation of the cold, dense gas.

We studied the dependence of numerical results on the volume filling factor of the HI clumps. We found that when the volume filling factor is large, the propagation speed of the jet is slow and arc-shaped cold dense region is formed. When the volume filling factor is small, propagation speed does not decrease so much and dense cloud distribution is more elongated. The distribution of the cold, dense gas and the length of the jet propagation speed depend on the filling factor.

We report the application of this model to molecular clouds toward the stellar cluster Westlund 2 and TeV $\gamma$-ray source HESS J1023-575 observed by NANTEN2 and Mopra telescope. HESS J1023-575 is located between these molecular clouds. The shape of molecular cloud on the right of HESS J1023-575 is like an arc and molecular clouds on the other hand distribute linearly. The difference of the filling factor can explain the difference of the shape of these molecular clouds.

Keywords: jet, interstellar medium, magnetohydrodynamics