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Magnetohydrodynamic Simulations of the Interaction of Magnetic Tower Jets with Interstellar Clouds including Cooling

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Abstract. We carried out magnetohydrodynamic (MHD) simulations to reveal the formation mechanism of molecular towers observed in the central region of our galaxy. These molecular clouds can be formed by the interaction of magnetic tower jet with the interstellar gas. When the jet collides with dense HI clouds, the HI gas is compressed by the bow shock ahead of the jet. Since the density enhancement triggers the cooling instability because it increases the cooling rate, the shocked gas cools down and forms cold, dense gas. We carried out MHD simulations including the cooling. The magnetized jet which triggers the formation of the molecular column appears in global magnetohydrodynamic simulations of accretion disks, in which the magnetic loops emerging from the disk are twisted by the differential rotation between the footpoints of magnetic loops anchored to the disk. Numerical results indicate that the magnetic loops expand, and form a magnetic tower. When the ambient density is small, the propagation speed of the tower can be as large as the rotation speed of the disk. When the ambient density is high, the collision of the jet and the HI cloud forms dense molecular tower.

Keywords. MHD — ISM: clouds — ISM: jets and outflows — ISM: molecules

1. Results

Figure 1. is the result of 2D simulations including cooling. In order to consider cooling, we adopted cooling function (Inoue *et al.* 2006).

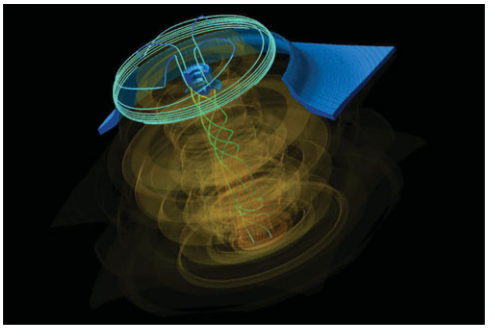

Figure 1. Result of simulations including cooling. Curves show the magnetic fields. Isosurface in the bottom region around the magnetic fields shows hot gas (T$> 10^5$K) and that in the top region shows cold dense gas.

References

T. Inoue, S. Inutsuka & H. Koyama 2006, *ApJ*, 652, 1331