Triggered Star Formation in a Turbulent ISM
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Molecular loops in the Galactic centre; evidence for magnetic floatation accelerating molecular gas

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The new molecular image obtained by NANTEN telescope in the galactic center has revealed the existence of the two loop like structures, loop 1 and loop 2, which have never been seen before toward $l = 355°$ to $358°$. The velocities of loop 1 and loop 2 are -180 to -90 km s^{-1} and -90 and -40 km s^{-1}, respectively, and these two loops have strong velocity gradients. The foot points of the loops show a very broad linewidth of $\sim$40 to 80 km s^{-1} whose large velocity spans are characteristic of the molecular gas near the galactic center. Therefore, we classified the loops as being located in the galactic center and adopt a distance of 8.5 kpc. Then, the projected lengths of loop 1 and loop 2 were estimated as $\sim$500 and $\sim$300 pc, respectively and velocity gradients corresponds to $\sim$80 km s^{-1} per 250 pc along loop 1 and $\sim$60 km s^{-1} per 150 pc along loop 2. The heights of these loops are also estimated as $\sim$220 to $\sim$300 pc from the galactic plane, significantly higher than the typical scale height in the nuclear disk.

Each of the loops has a mass of $\sim 0.8\times10^5$ M$_\odot$ as a lower limit by combining the ^{12}CO and ^{13}CO data and assuming local thermodynamical equilibrium at 50 K. The kinetic energy in a loop was estimated to be $\sim 0.9\times10^{51}$ erg for a velocity dispersion of 30 km s^{-1}. The velocity and the energy of loops can not be explained by a super nova. Therefore, we offer a model incorporating MHD instability to explain the formation of the two loops. From this model we found that two model loops calculated by an MHD code were a good match for the observations. We used parameters of 100 cm^{-3} in gas number density and 150 μm in magnetic field. Then, the Alfven speed was calculated as 24 km s^{-1}.

This model offers naturally significant heating of the warm molecular gas at the foot points. The velocity dispersion of the broad CO features corresponds to kinetic temperature higher than about 10^4 K if the shock is completely converted into thermal energy at the foot points. We suggest that the present model has the potential to be applied to the other salient broad velocity features in the galactic center and to the heating of the molecular gas at their foot points.

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