Group 5:
Magnetorotational Instability in Accretion Disks and Jet Formation

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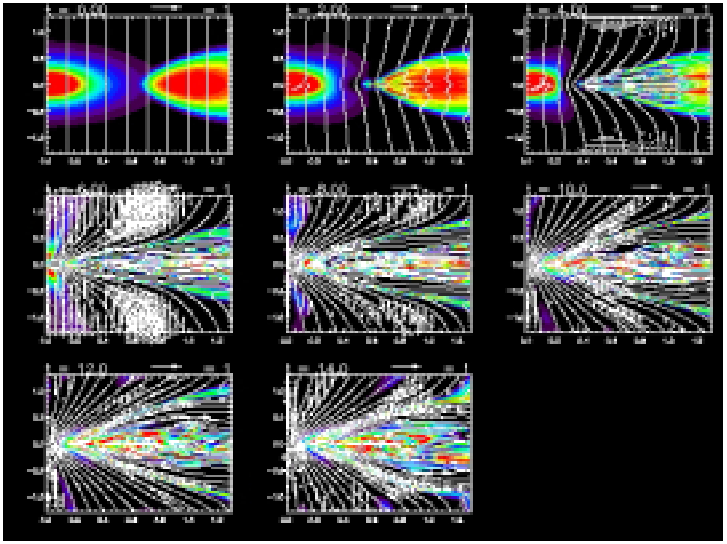
The effect of perturbations inside the disk

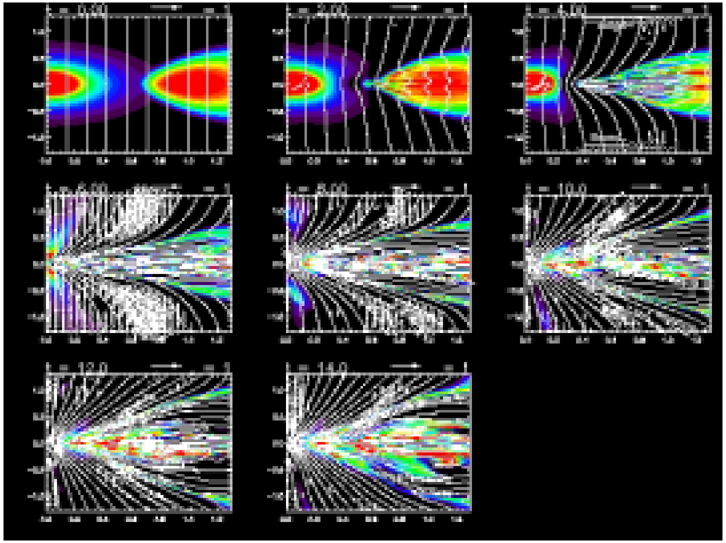
by Y. Masada

These figures show the distribution of plasma beta. We assume the initial magnetic field has only vertical direction and the strength is about **β**=20 at coronal region. The left panel shows the results when the “cosine” type (symmetric) perturbation is imposed, and the right one shows the results when the “sine” type (anti-symmetric) perturbation is imposed. In both models, MRI grows inside the disk and enhances the mass outflows.

$v_r = \delta v_r \cos(8\pi z)$

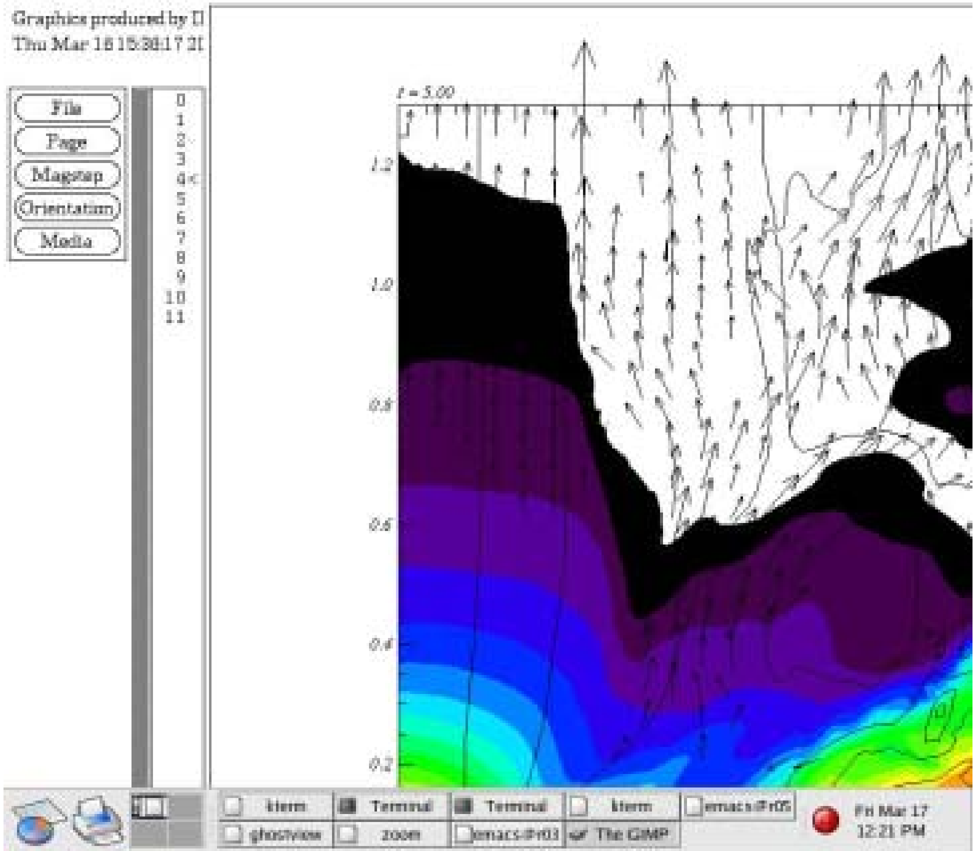


$v_r = \delta v_r \sin(8\pi z)$



The effect of magnetic field direction

by Ibrahim

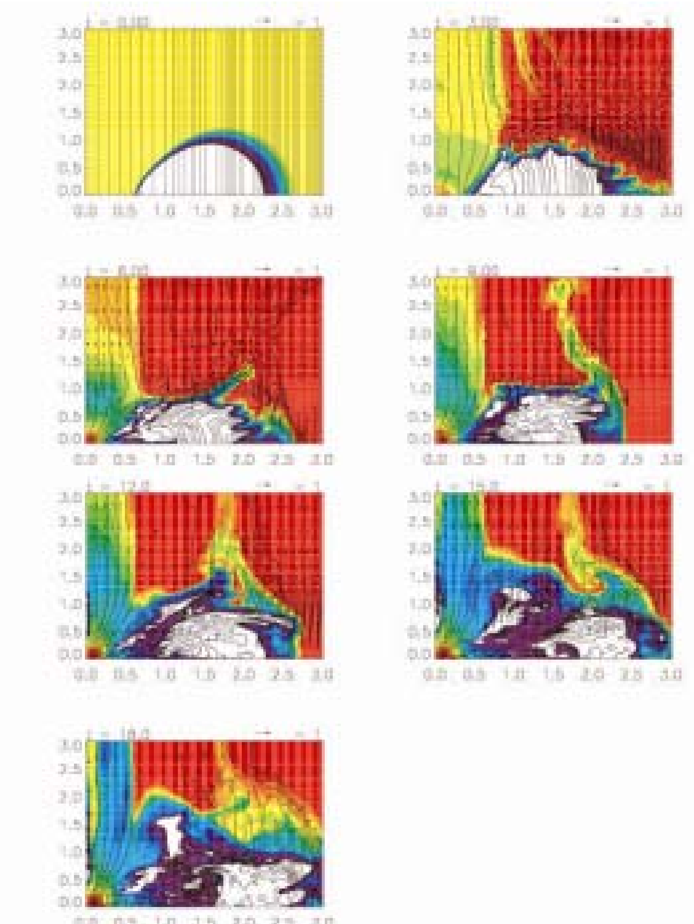


We studied jet formation when the initial vertical magnetic field changes direction with radius. In contrast to the uniform vertical magnetic field models, vertical magnetic field does not accumulate near the rotation axis. Jets are formed from the radius outer than the uniform field models. Magnetic islands are created around the current sheet.

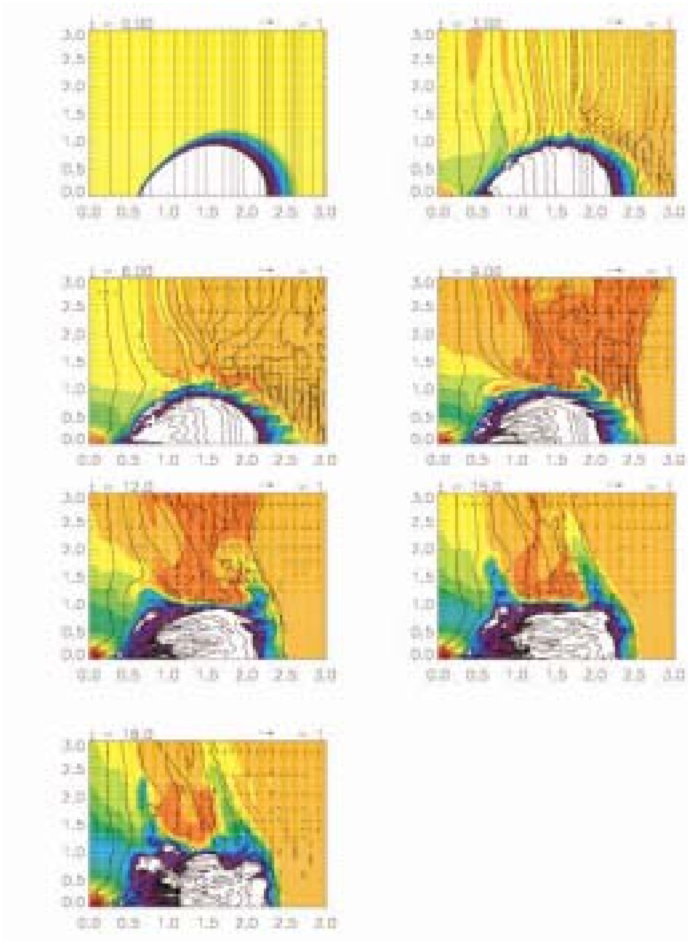
Dependence on the initial plasma beta
(for Net-zero Initial Magnetic Fields)

by Kawahara and Nakanishi

Low beta (strong magnetic field) case

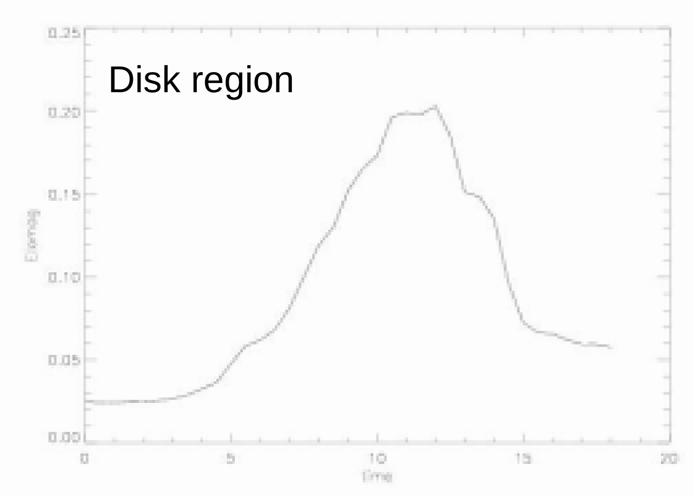


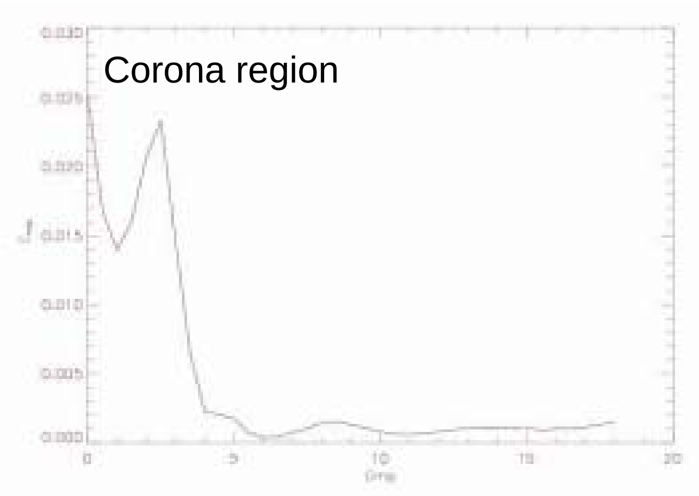
High beta (weak magnetic field) case



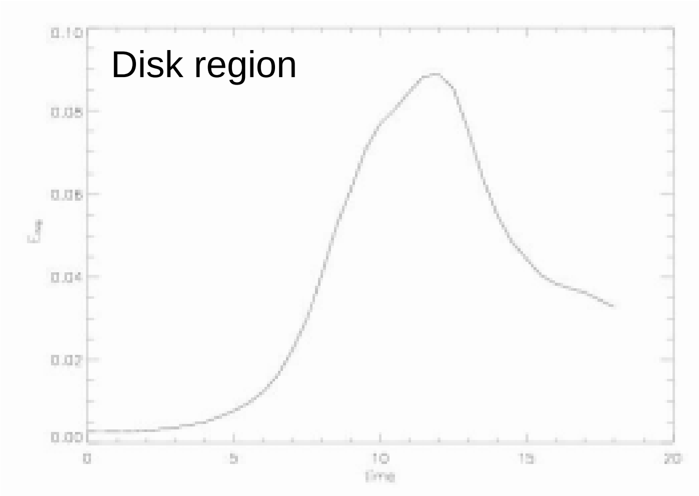
Time evolution of magnetic energy

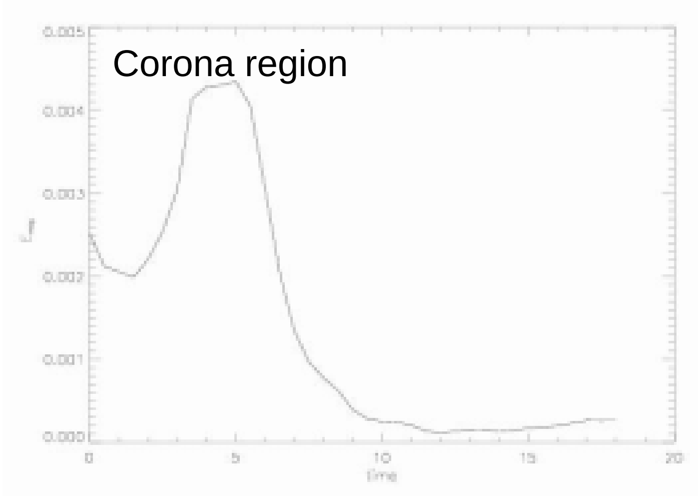
Low beta case





High beta case



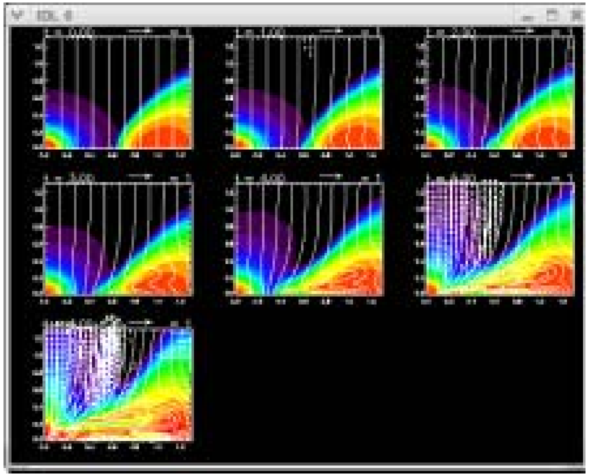


The effect of radiative cooling term

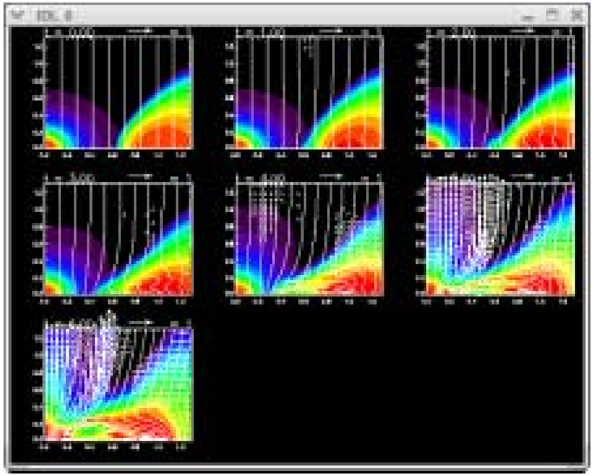
by Yuan ang Yang

In order to study the effect of radiative cooling term, we assume the optically thin bremsstrahlung cooling term. When we assume weak radiation, the results are similar to the non-radiation case. However, when we assume the strong radiation, the initial torus shrinks in the vertical direction, and the mass accretion becomes different from the non-radiation case. Dense cool blobs are formed when strong radiative cooling is included.

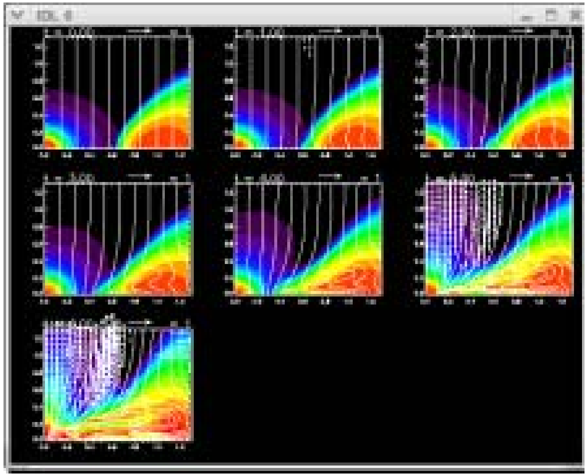
Non radiation case



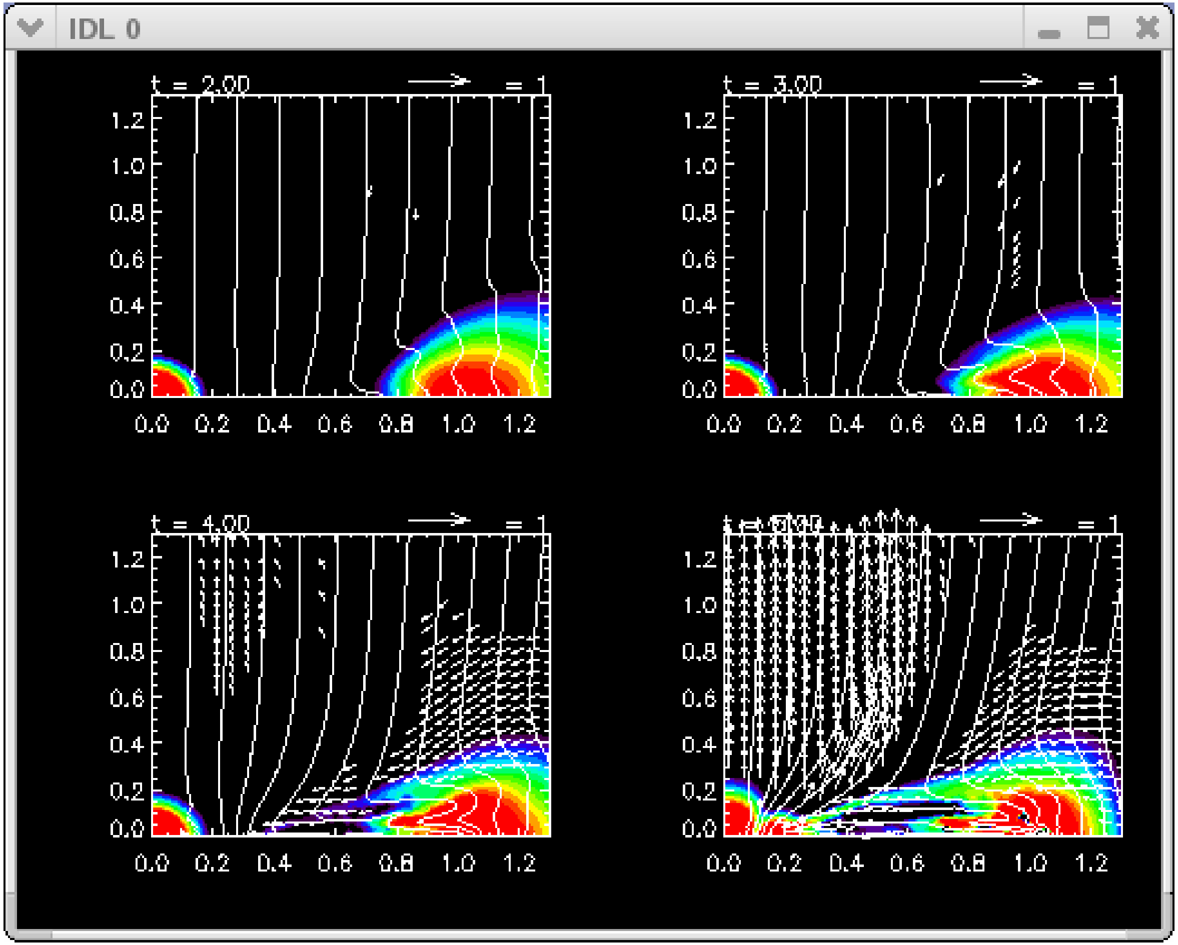
Strong radiation case



Weak radiation case



The distribution of luminosity



Conclusion

- Mass outflow rate increases when perturbations are imposed inside the disk. There are not significant differences on the parity of initial perturbation in this parameter region.
- When the initial magnetic flux is net zero, strong outflow is created around the current sheets.
- When the initial plasma beta is low, the jet propagation speed becomes high. However, the magnetic energy inside the disk is almost the same as the high beta case.
- The less magnetic turbulence is created when the strong radiation is included. But the outflow structure is almost the same as the non-radiation case. Dense cool blobs are created by cooling.