of = 9 pc, which is significantly smaller than the radius (14pc) of W44 in radio continuum. Most of the X-ray emission in W44 originates from the interior of the H I shell. Neither the standard Sedov model nor an evaporative model can explain the two shell structure with a centrally-peaked X-ray emission of W44. We propose that the H I shell is a pre-existing shell that has been reaccelerated by the supernova blastwave. The blastwave apparently has overtaken the wind-blown shell and is propagating into the ambient interstellar medium. We discuss the dynamical evolution of W44

Nonlinear Evolution of the Parker Instability

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We examined the effect of the mode interaction to the nonlinear of the Parker instability in the background nonuniform gravitational fields. The initial equilibrium state taken is the same as that of the model Ao(Matsumoto et al. 1988) except for the geometrical size, and the type of perturbation. The random perturbation is taken in order to incorporate the spectra of the unstable mode. In particular, we emphasized the specific mode characterized by the horizontal length by enforcing the periodic boundary condition in horizontal direction.

As the instability grows, the structure of the model whose horizontal length Xmax is equal to the wavelength of the most unstable fundamental mode (max = 6.16), converges to the configuration as shown by Matsumoto et al.. For X max > max, the most unstable, fundamental mode is still dominant. But slant spurs grow as they interact with neighboring ones. We find material in galactic plane is more condensed by the strong shockwave, despite their column ratio is not so different from the case of X max= max.

Gravitational Instabilities in a Protoplanetary Disk Including the Effects of Magnetic Fields

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We investigate the gravitational instability of a thin, Keplerian protoplanetary disk including the effects of a largely azimuthal magnetic fields. The disk is assumed to consist of neutral and ionized gas and neutral dust which are coupled by gravity and friction. The growth rate and eigenfunctions are calculated numerically using non-axisymmetric linear perturbation methods. The results show that the growth rate has a maximum at some intermediate azimuthal number m, but for each value of m it is reduced relative to the

unmagnetized case. The effects of the magnetic field appear more strongly on small scale. As the strength of the equilibrium magnetic field increases the growth rates decreases, and the maximum instability occurs at lower value of m due to the increasing magnetic pressure. With the inclusion of the magnetic field, the effects of the ionization fraction and friction on the grows rates also appear to be important for high m modes. Increasing the ionization fraction or the friction suppresses instability, but only slightly changes the maximally unstable azimuthal scales. The enhanced growth rates due to a dust component for which thermal pressure is negligible are somewhat reduced by the inclusion of a magnetic field. The effects of different boundary conditions (reflecting and transmitting) on the growth rates are also shown.

The structure and Stability of Two-Temperature Accretion Disk

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The structure and stability of the gas pressure dominated, thin accretion disk, cooled by Comptonization of the central soft photons is studied. Steady-state solutions have two branches: High-temperature (HT) solutions have very different ion and electron temperatures and correspond to the classic solutions of Shapiro, Lightman, and Eardley. Low-temperature (LT) solutions have same ion and electron temperature, which is very close to the Compton temperature of soft photons.

The linear analysis, allowing for the surface density perturbations and dynamics in the vertical direction, shows that LT disk is stable while HT disk is not. LT disk is stable because ions and electrons are locked to the Compton temperature of the soft photons. HT disk generally has 4 local modes: (1) Heating mode grows in thermal time scale, (5/3)(α ω)-1, where ω is Keplerian frequency. (2) Cooling mode decays in Compton time scale, (2/5)(Te/Ti)(αω)-1 << (αω)-1. (3) Lightman-Eardley mode decays in viscous time scale, (8/11)(?/Ho)2(αω)-1, where ? is the wavelength of the perturbation and Ho is the disk height. (4) Vertical oscillatory modes oscillate in Keplerian time scale, (3/8)1/2ω-1 with the growth rate (Ho/?)2. Including dynalics in the vertical direction does not change the stability behavior in general, adding only the oscillatory modes which gradually grow as Ho/? increases.

Non-linear behavior of the disk is followed by numerical integration. Cooling function covering both effectively optically thin and thick cases is used. Only the ion temperature perturbation is important and the disk either expands or collapses vertically, depending on the sign of the perturbation. When expanding, the ion temperature becomes very high while the electron temperature very low, resulting in runaway behavior due to the decreased Coulomb coupling, especially so if the ion velocity effect is considered. When