

# Evolution of the Magnetized Gas in Spiral Galaxies

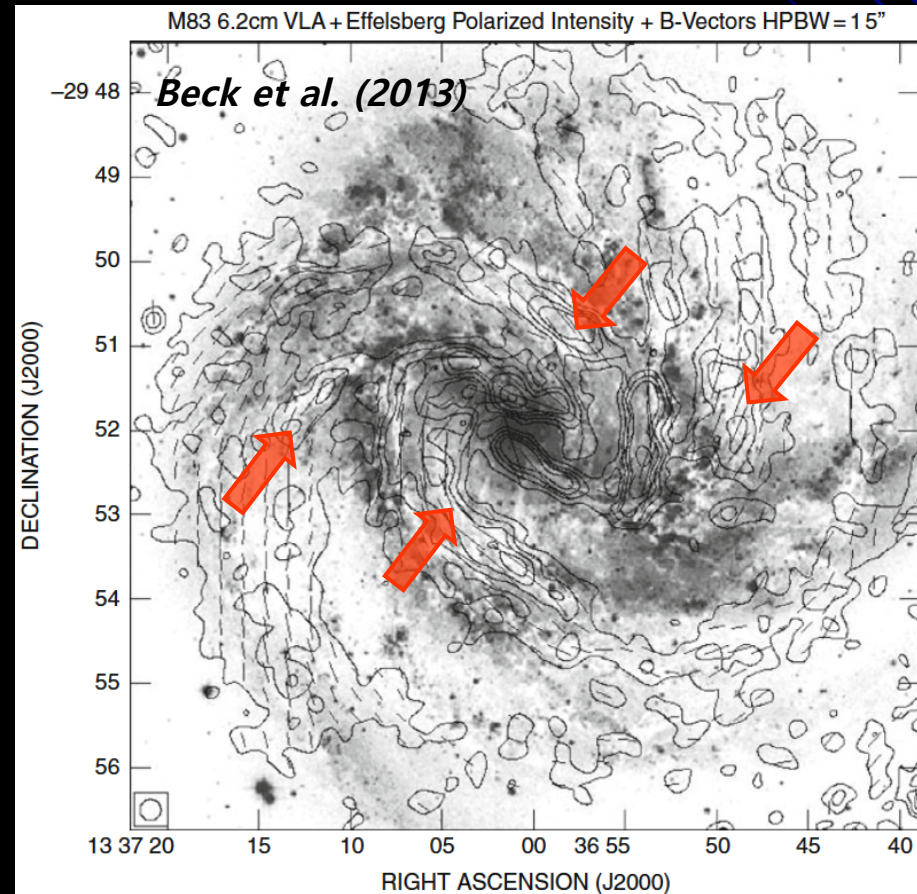
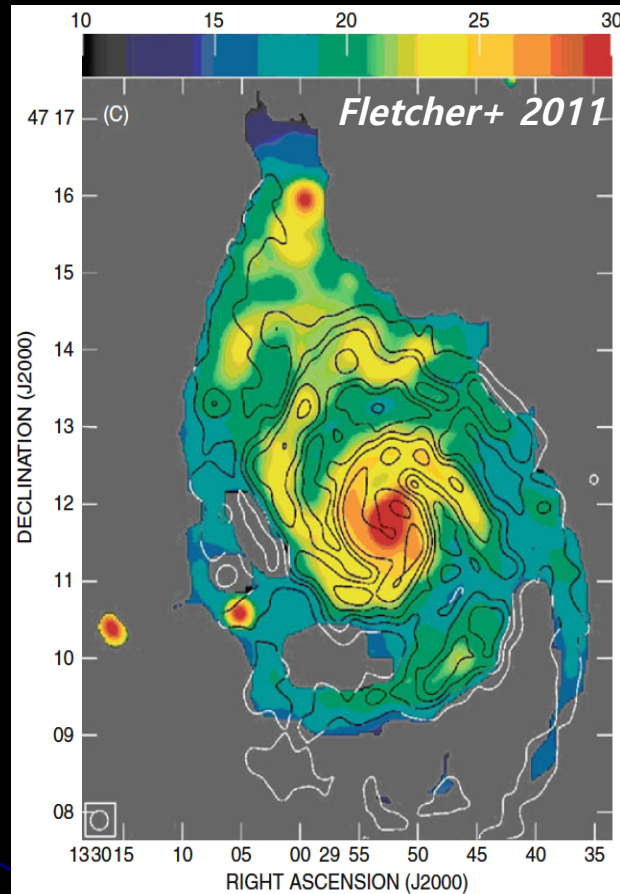
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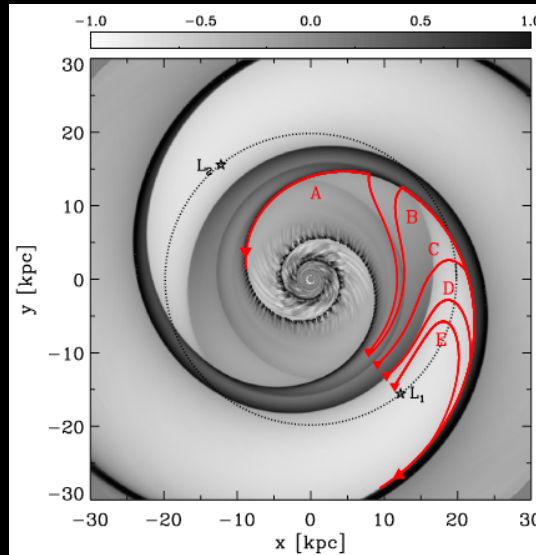
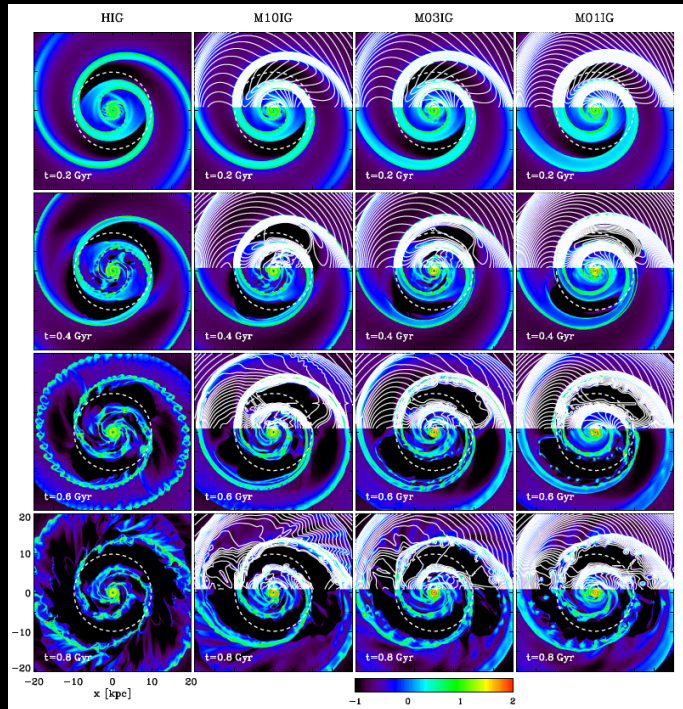
The 7<sup>th</sup> KIAS Workshop, Oct. 31-Nov. 4, 2016  
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# Significance of Magnetic Fields



- Total field strength (Fletcher+ 2011; Beck & Wielebinski 2013)  
 :  $\sim 20\text{-}25\mu\text{G}$  (arm regions),  $\sim 10\text{-}15\mu\text{G}$  (interarm regions)  
 cf. averaged strength of intergalactic field  $\geq 10^{-10}\mu\text{G}$  (Neronov & Vovk 2010)

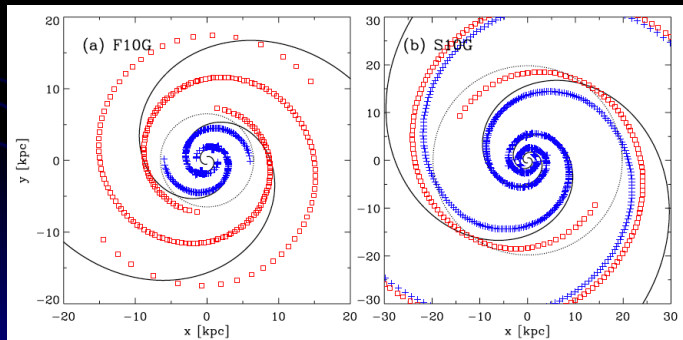
# Shock Formation and Extent



Radial amplitude of the epicyclic orbits

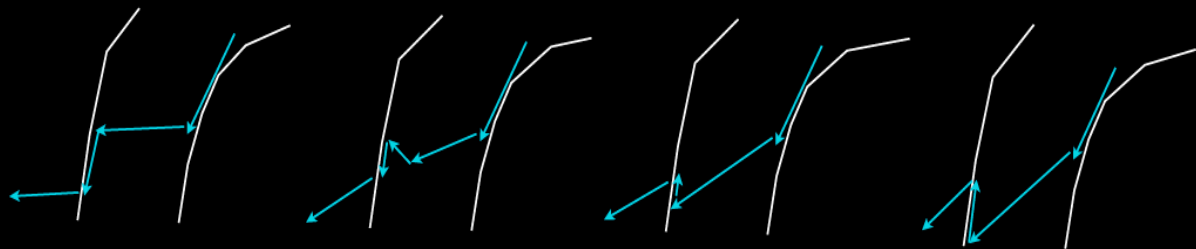
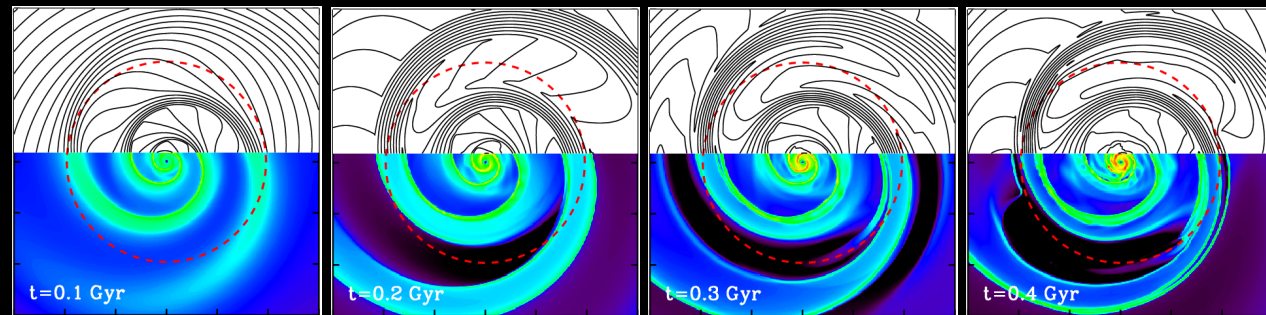
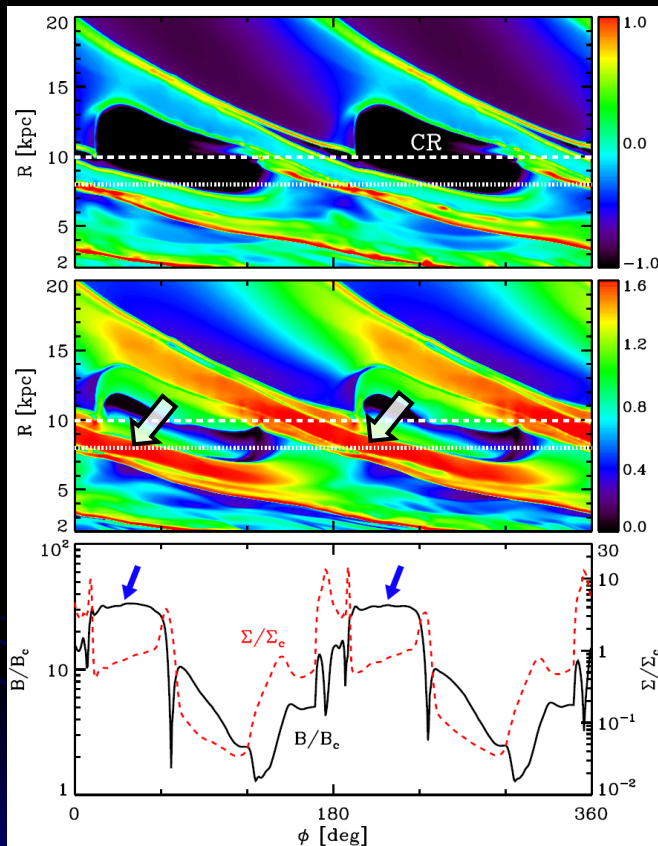
$$\Delta R = \Delta v_R / \kappa$$

- At the CR of **S** models ( $\Omega_p = 10 \text{ km/s/kpc}$ ;  $R_{\text{CR}} = 20 \text{ kpc}$ )  
:  $\Delta v_R = 36 \text{ km/s}$  &  $\kappa = 13 \text{ km/s/kpc}$   $\rightarrow \Delta R = 2.7 \text{ kpc}$
- At the CR of **F** models ( $\Omega_p = 30 \text{ km/s/kpc}$ ;  $R_{\text{CR}} = 6 \text{ kpc}$ )  
:  $\kappa > 100 \text{ km/s/kpc}$   $\rightarrow \Delta R = 0.1 \text{ kpc}$   
: too small to make shocks extended across the CR

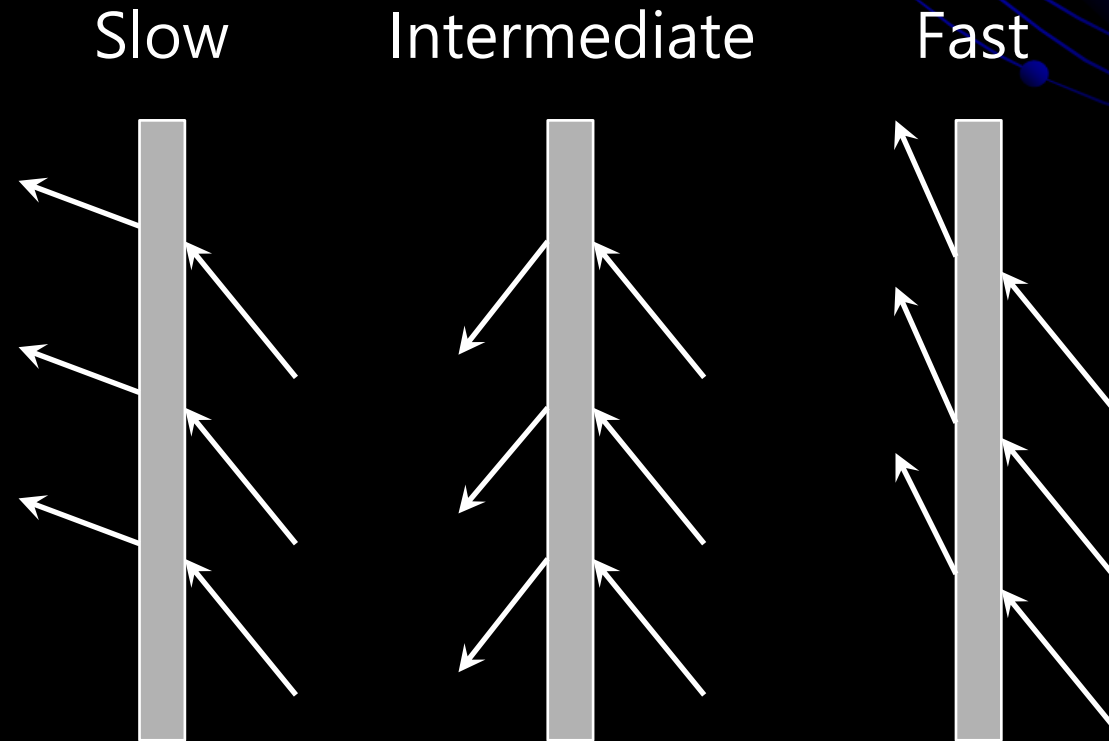
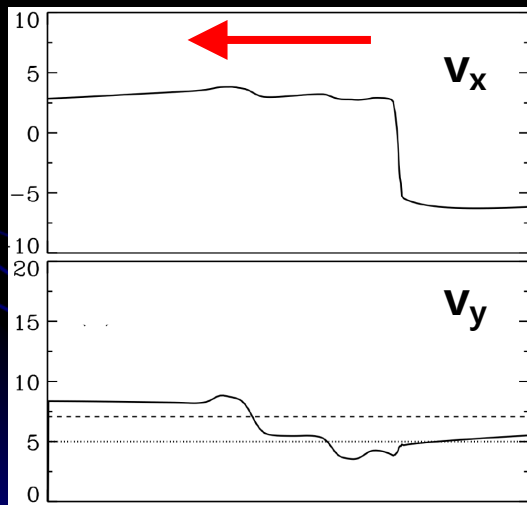
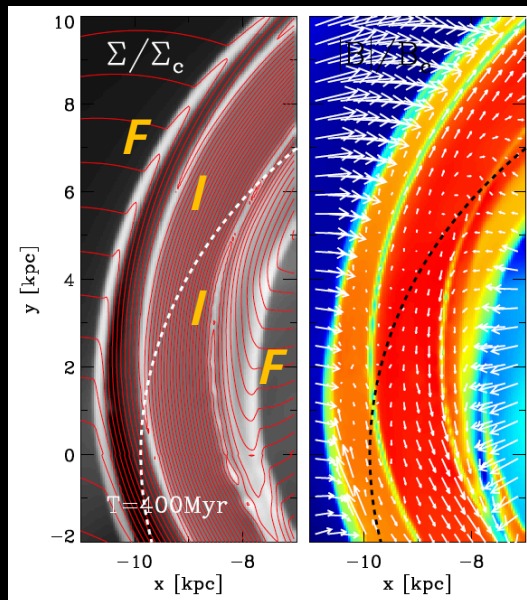


# Magnetic Reversals and Accumulation

- Accumulation of magnetic fields near the CR by radial velocity perturbations due to the bounded spiral shocks  $\Rightarrow$  Magnetic Arms



# Effects of B Field



- $v_{2x} < v_{1x}$   
 :  $v_{2y} < v_{1y}$  for a **slow** shock  
 :  $v_{2y} > v_{1y}$  for a **fast** shock
- $B_{2x} = B_{1x} = v_{2x} = v_{1x} = 0$  : for an **intermediate** wave