

5. Galaxies

Gas phases

Phase	n [cm ⁻³]	T [K]	f_V [%]	f_m [%]	h [pc]	Tracer
Molecular	$10^2 \dots 10^5$	10 ... 50	< 1	~20	~70	CO
Cold neutral	40 ... 80	50 ... 200	2 ... 4	~40	~140	HI (abs.)
Warm neutral	0.1 ... 0.6	5500 ... 8500	~30	~30	~400	HI (emission)
Warm ionized	~0.2	~8000	~20	~10	~900	H α , radio
Hot ionized	$10^{-3} \dots 10^{-2}$	$10^5 \dots 10^7$	~50	~1	≥ 1000	[OVI], X-rays

spiral



elliptical



dwarf

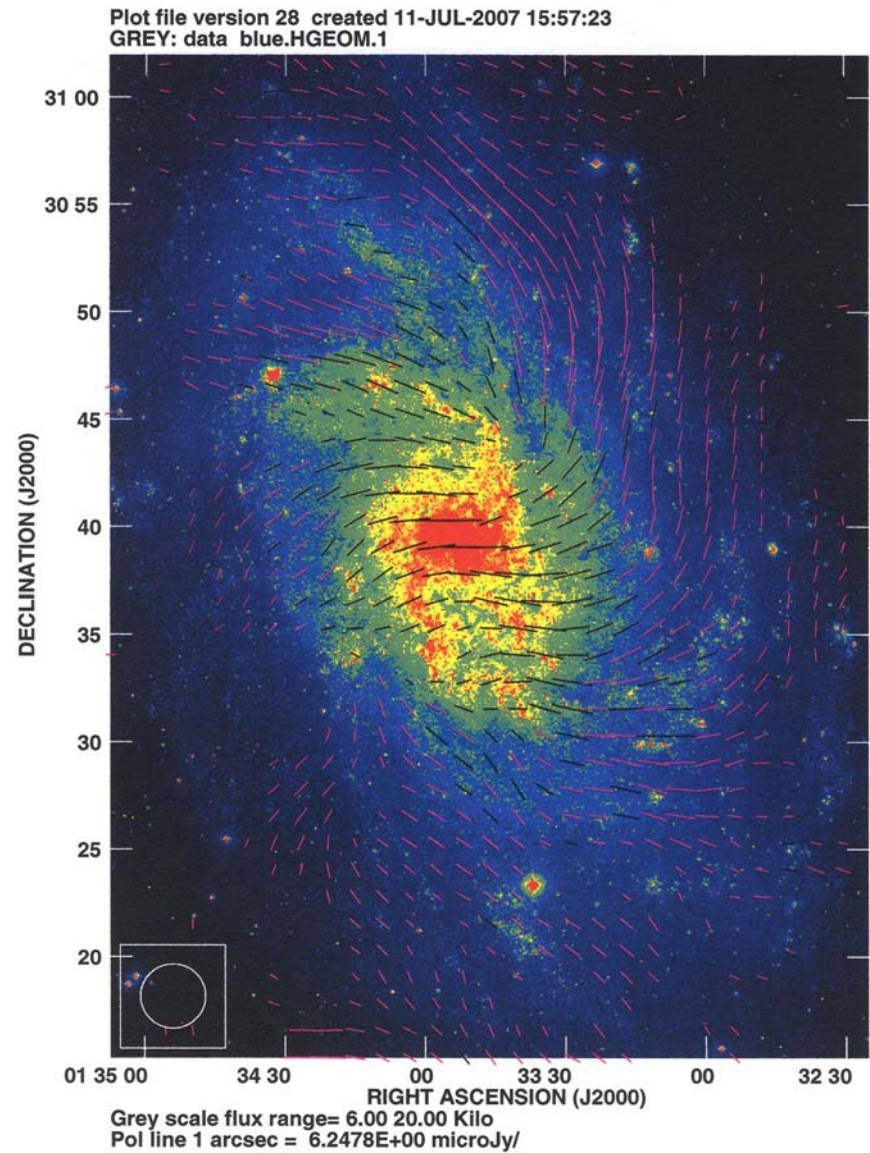


Spiral galaxies

M 51



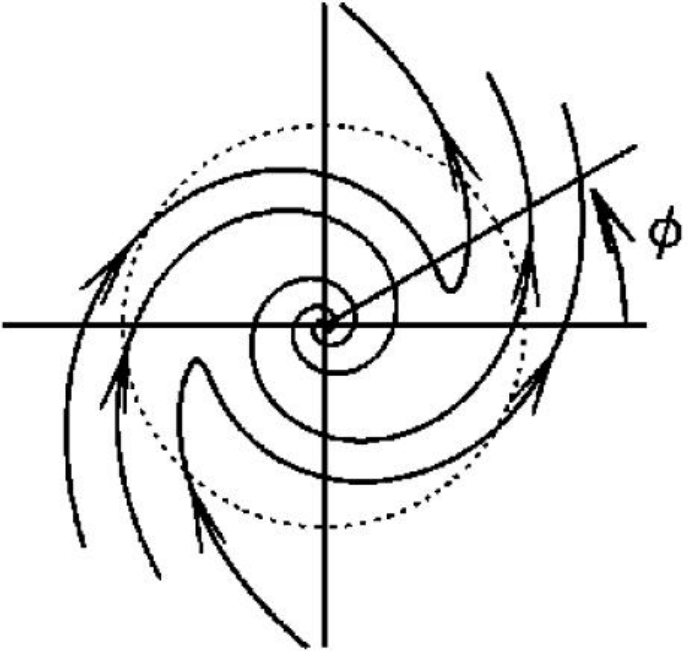
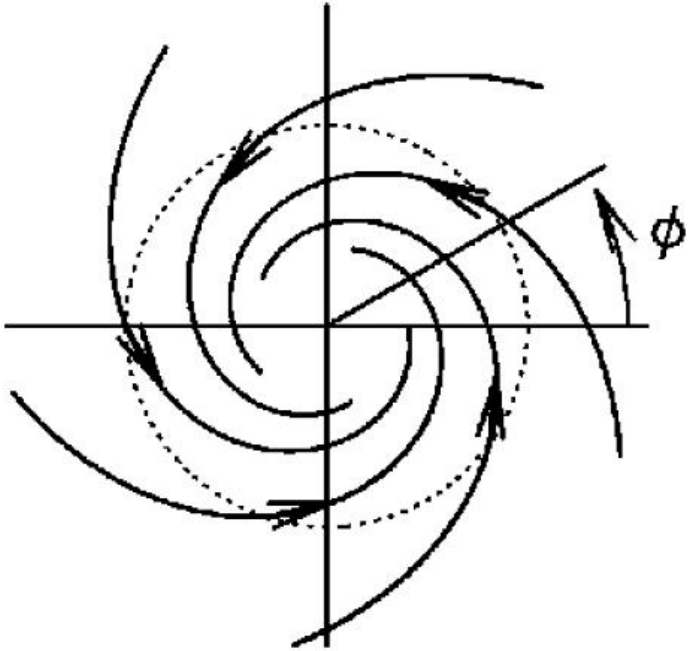
M 33



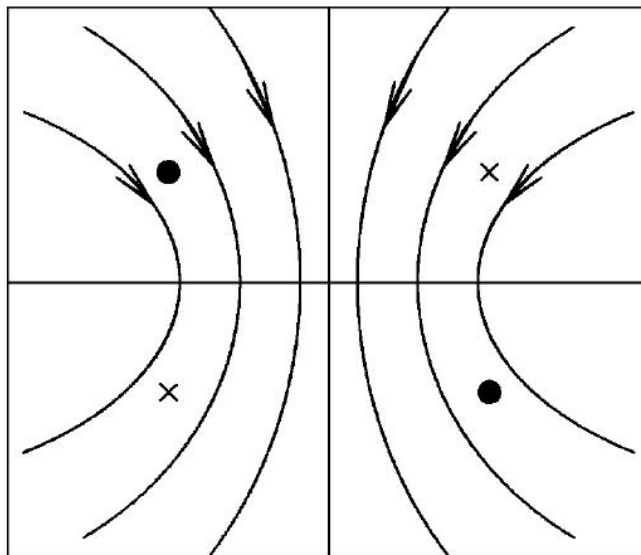
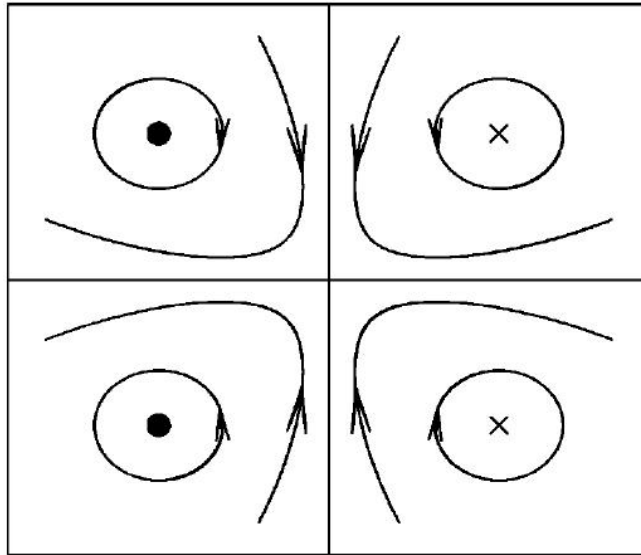
axisymmetric

bisymmetric

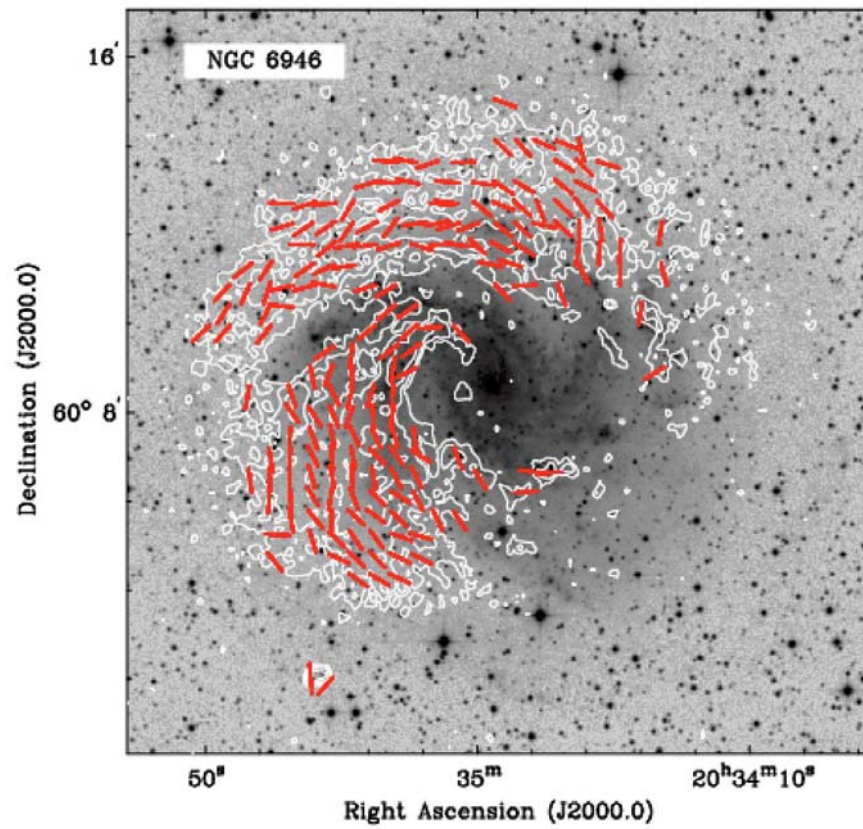
magnetic field structure



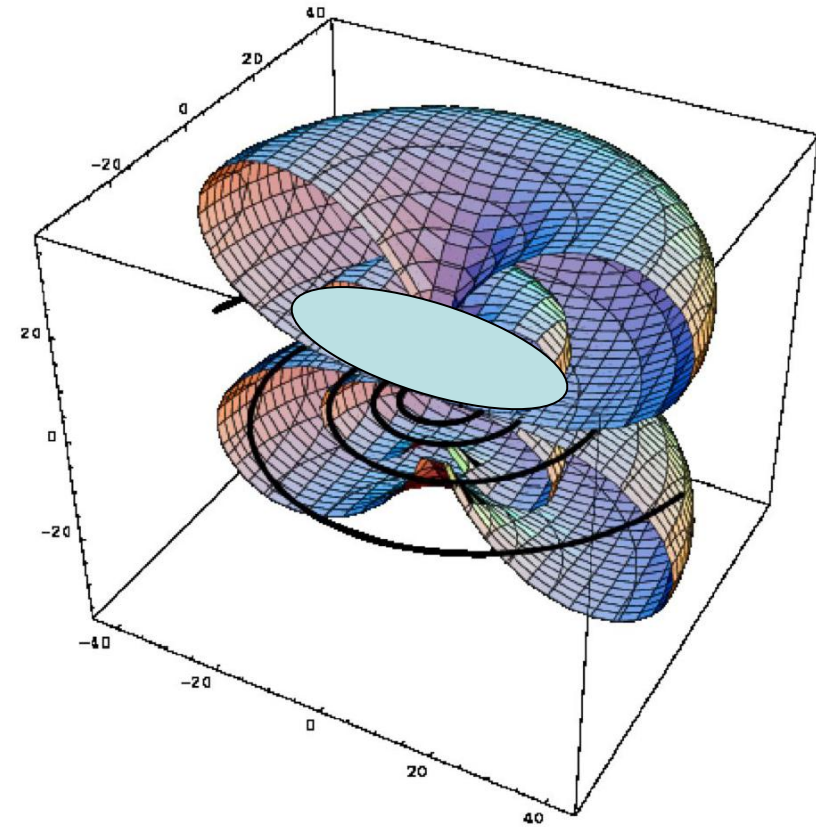
toroidal and poloidal field



polarisation asymmetry

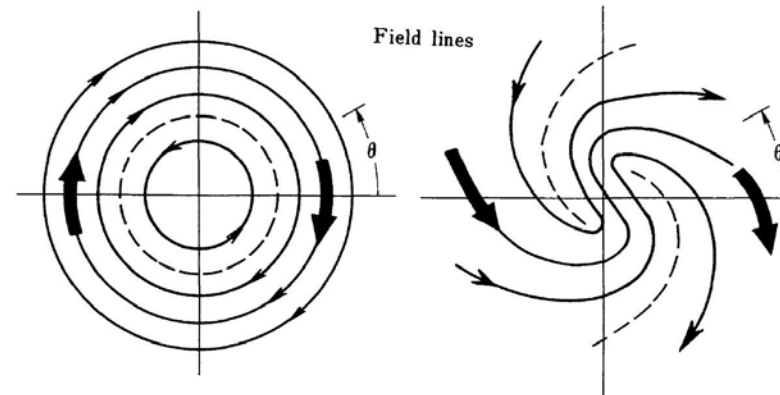
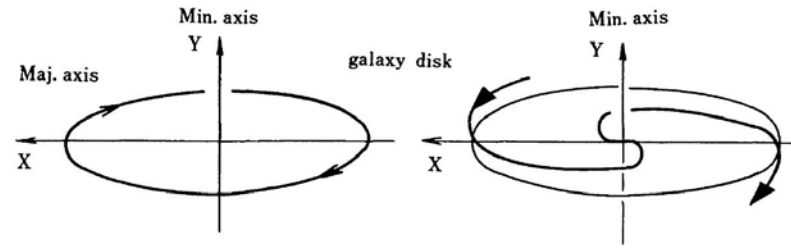


quadrupolar B-field structure

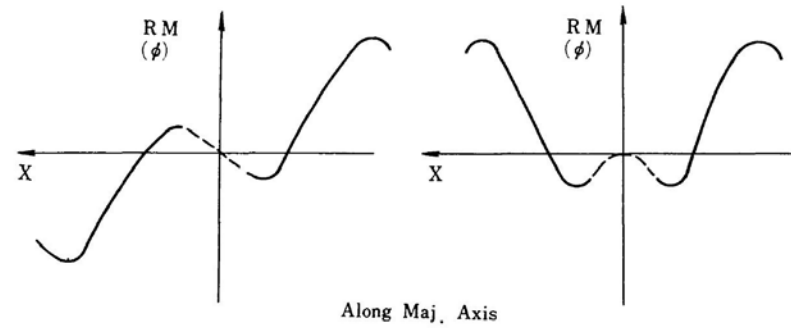


Braun et al. (2010)

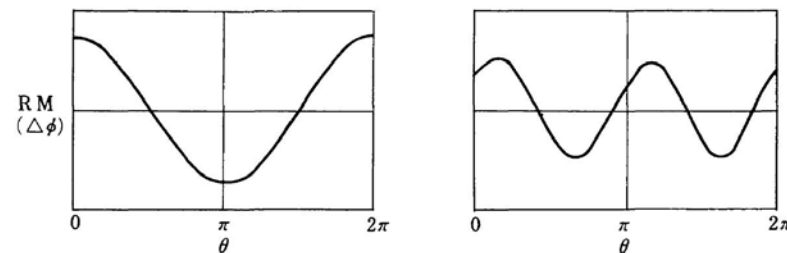
B-field structures and RMs:



along major axis

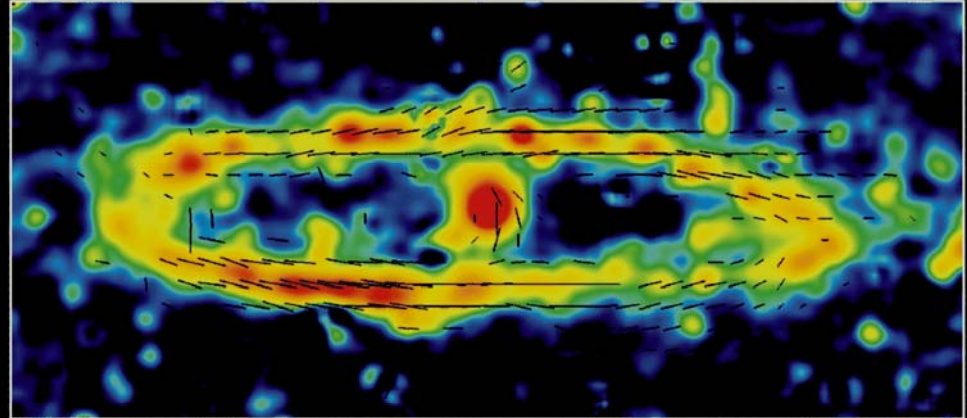


along azimuthal path



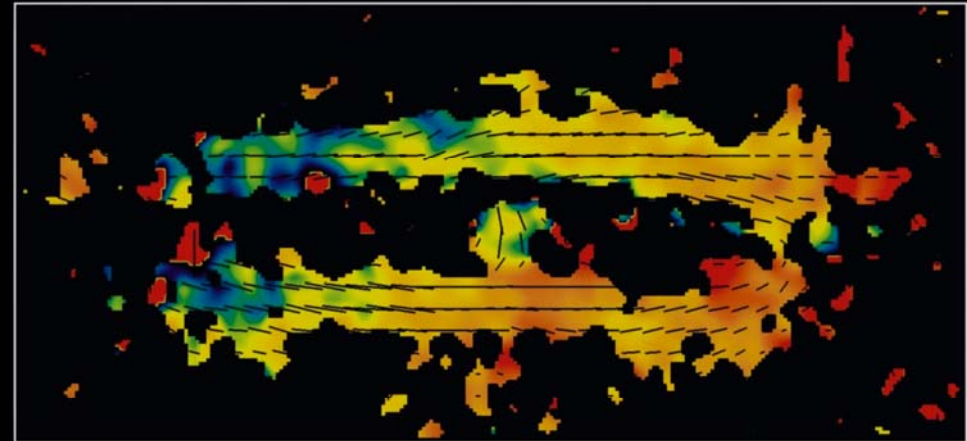
B-field structure and RM in M 31:

M31 6cm Total Intensity + Magnetic Field (Effelsberg)

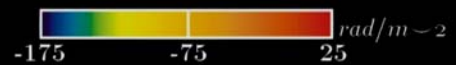


Copyright: MPIfR Bonn (R.Beck, E.M.Berkhuijsen & P.Hoernes)

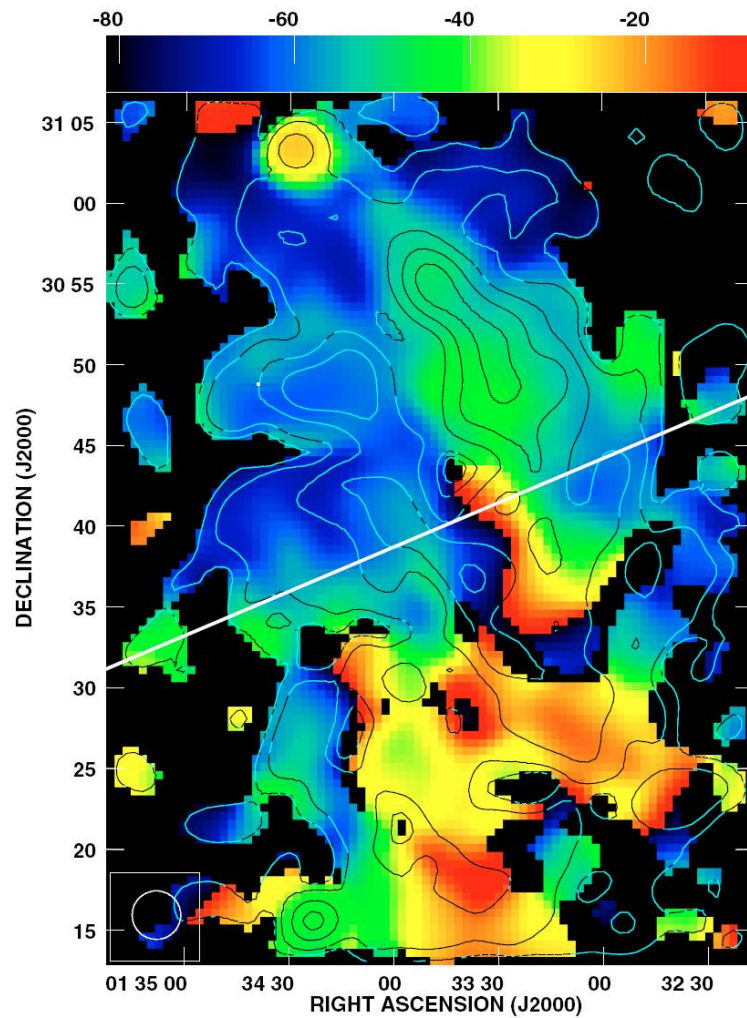
M31 RM 6/11cm + Magnetic Field (Effelsberg)



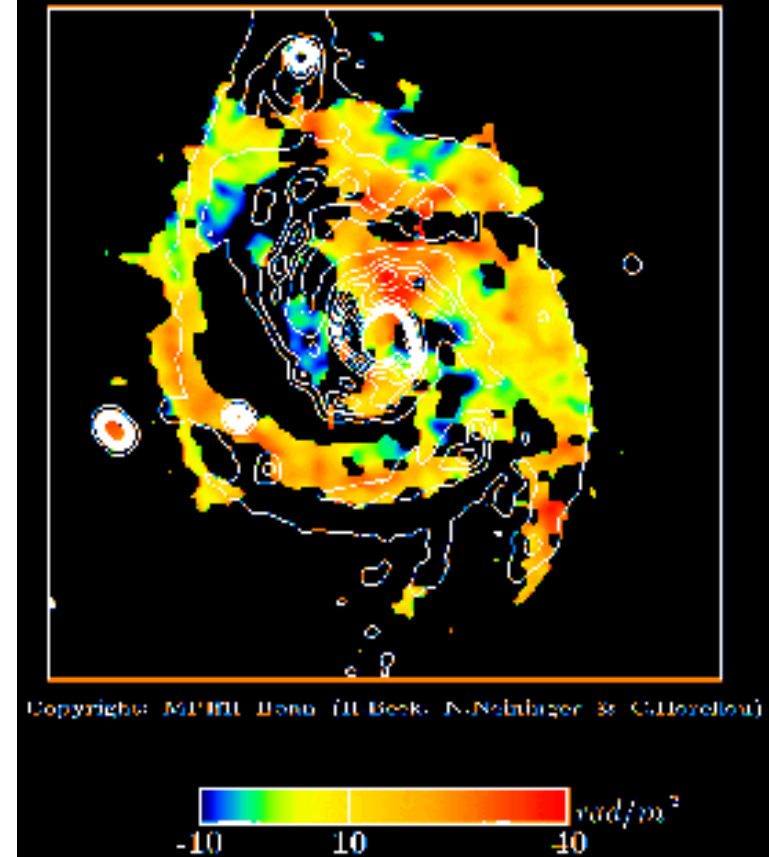
Copyright: MPIfR Bonn (R.Beck, E.M.Berkhuijsen & P.Hoernes)



RM in M 33



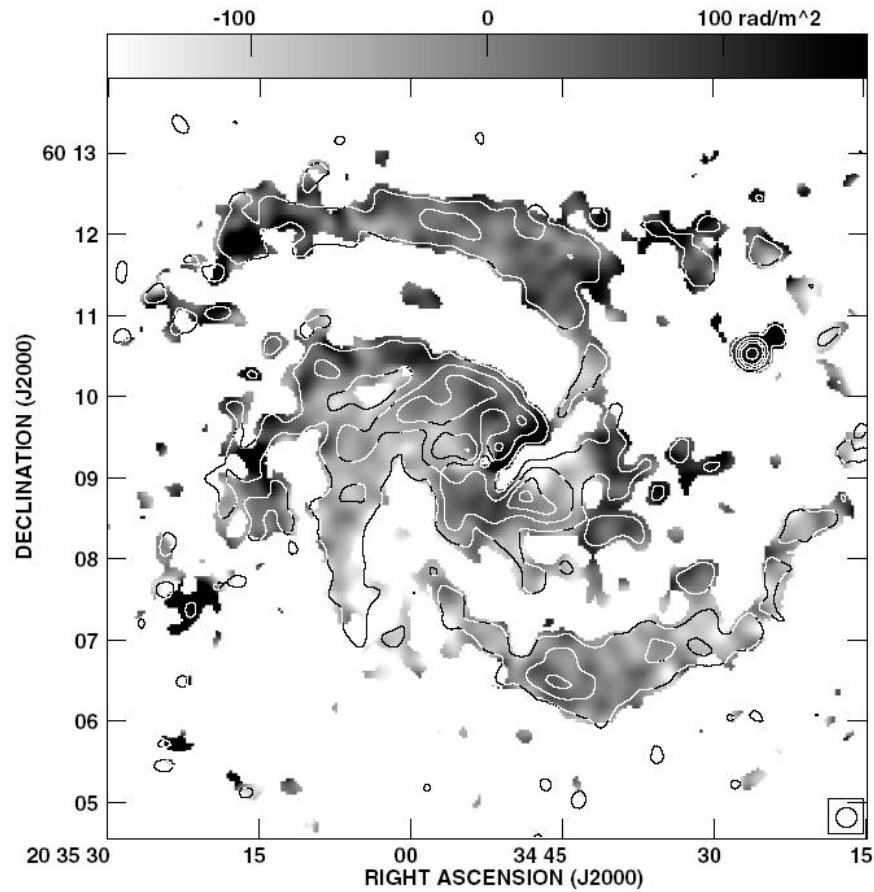
M51 RM 6/20cm (VLA+Effelsberg)



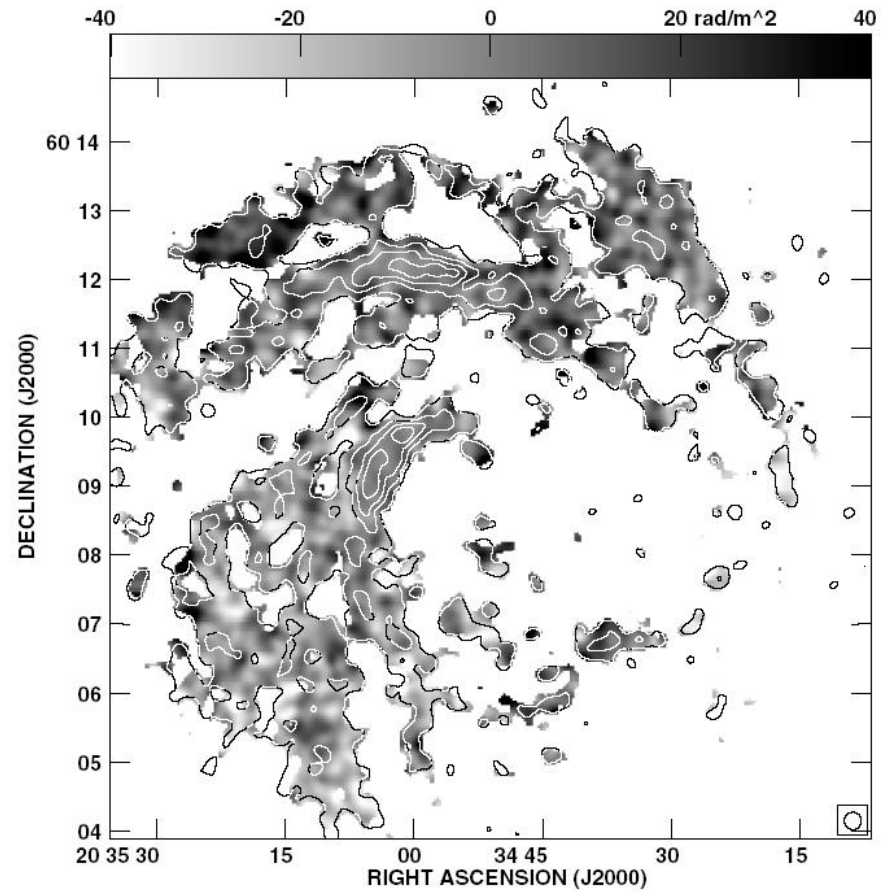
RM in M 51

RM in NGC 6946

NGC6946 RM (3/6cm) + Polarized Intensity (6cm) HPBW=15"

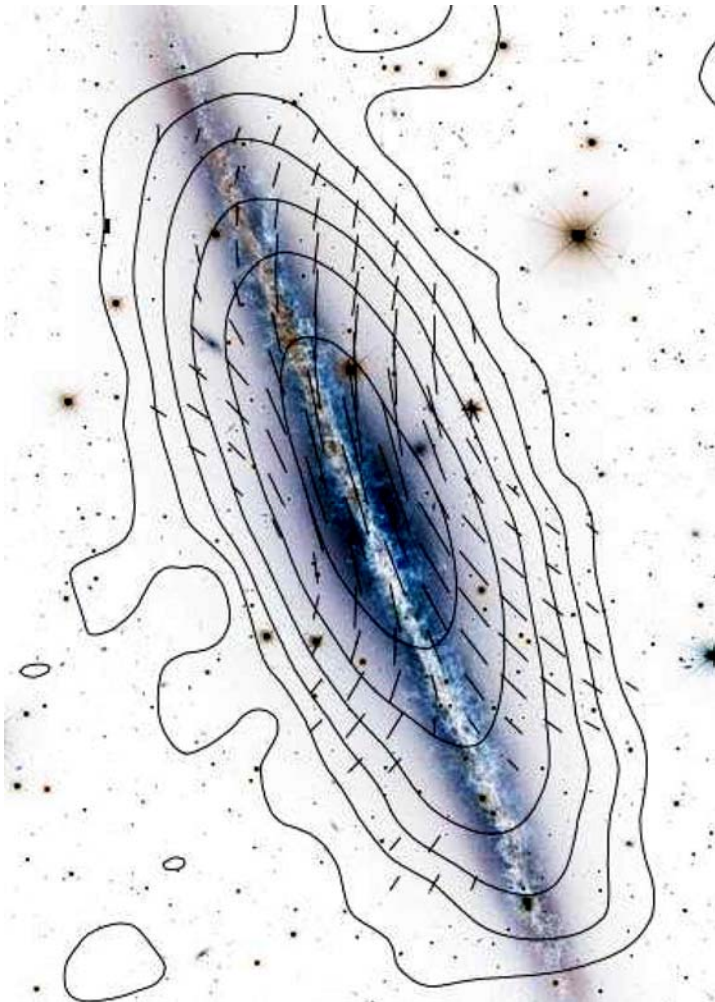


NGC6946 RM (18/20cm) + Polarized Intensity (20cm) HPBW=15"

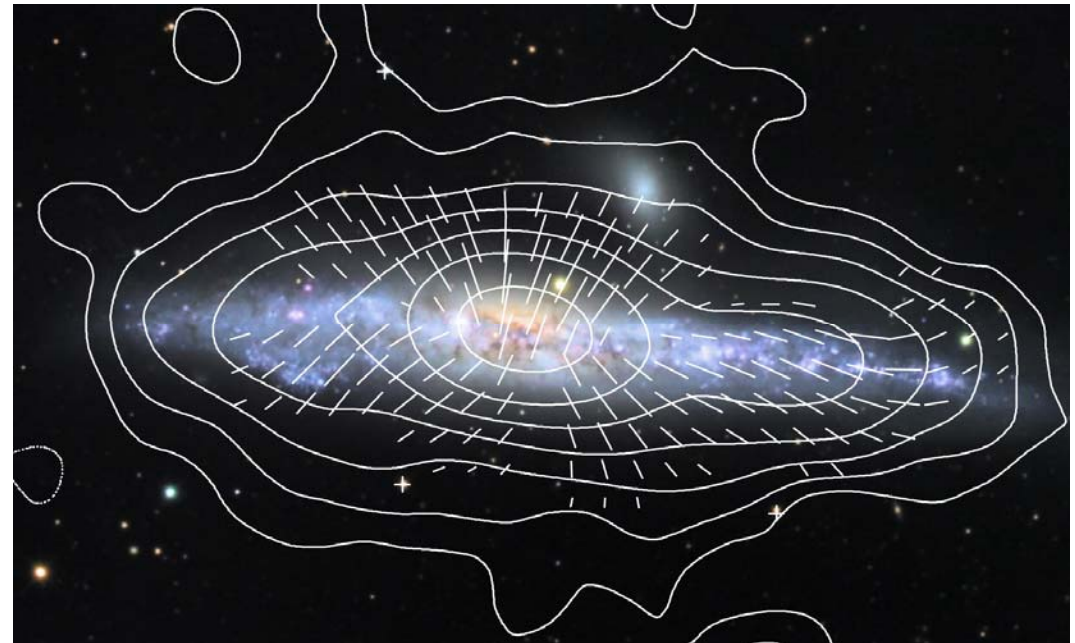


polarized emission from edge-on galaxies
B-field structure

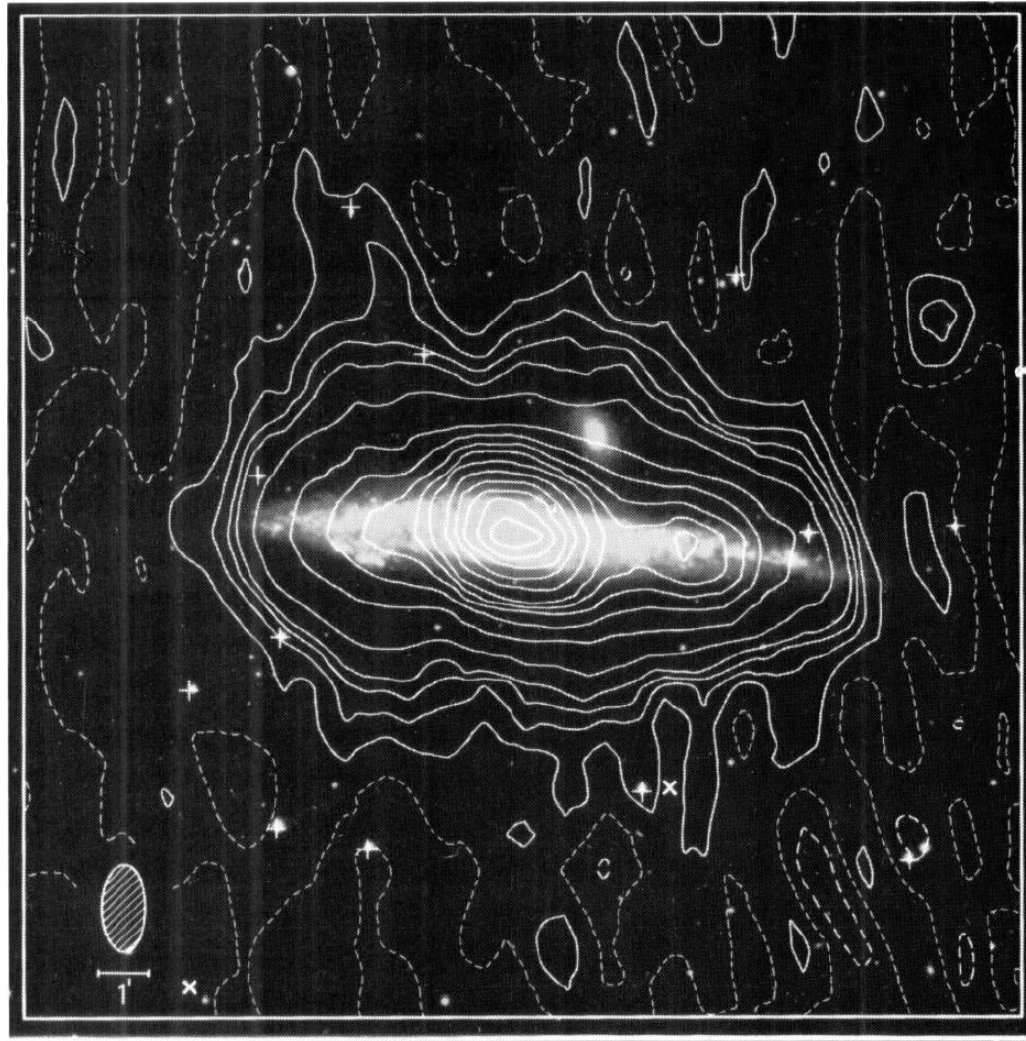
NGC 891



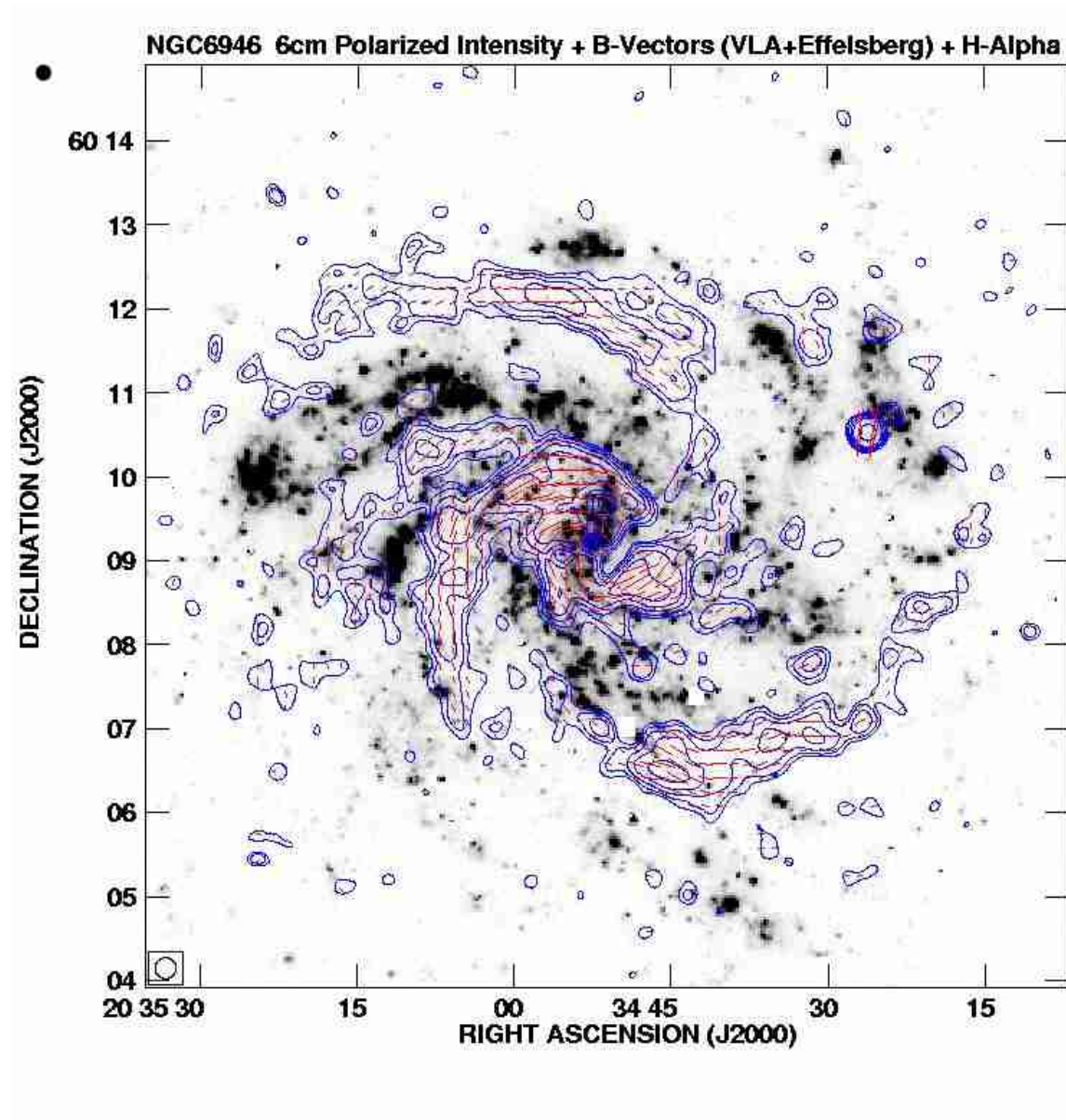
NGC 4631



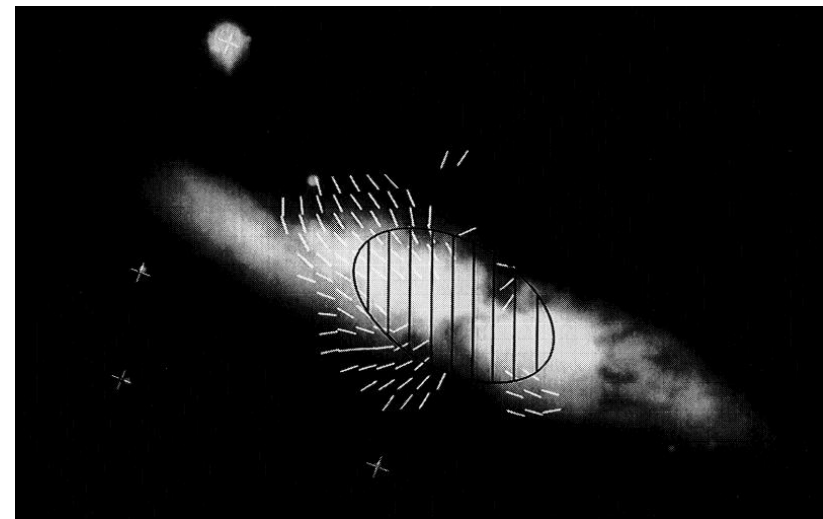
radio continuum halo in NGC 4631 at 49 cm wavelength



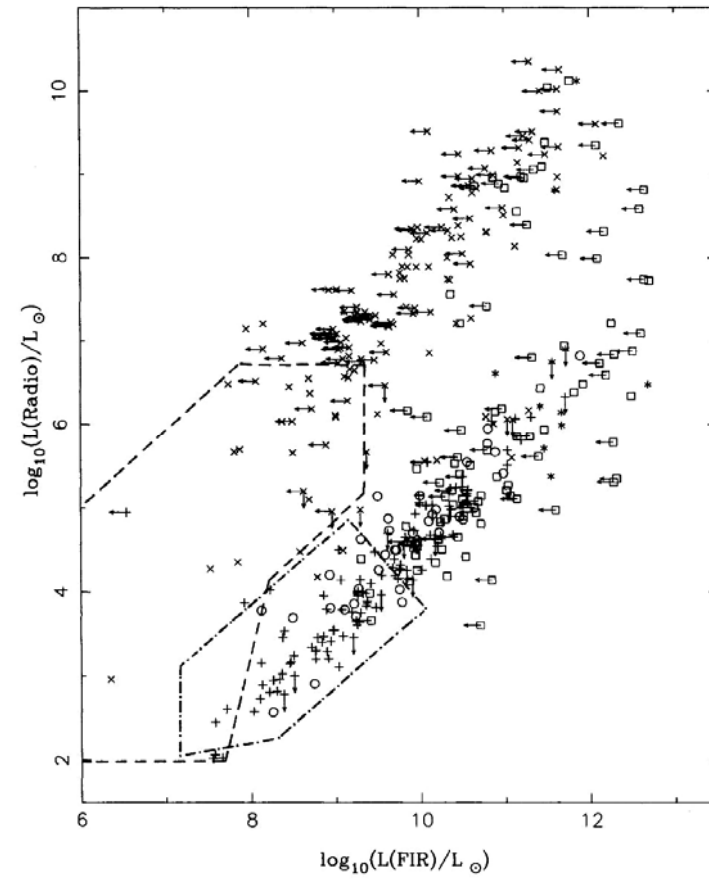
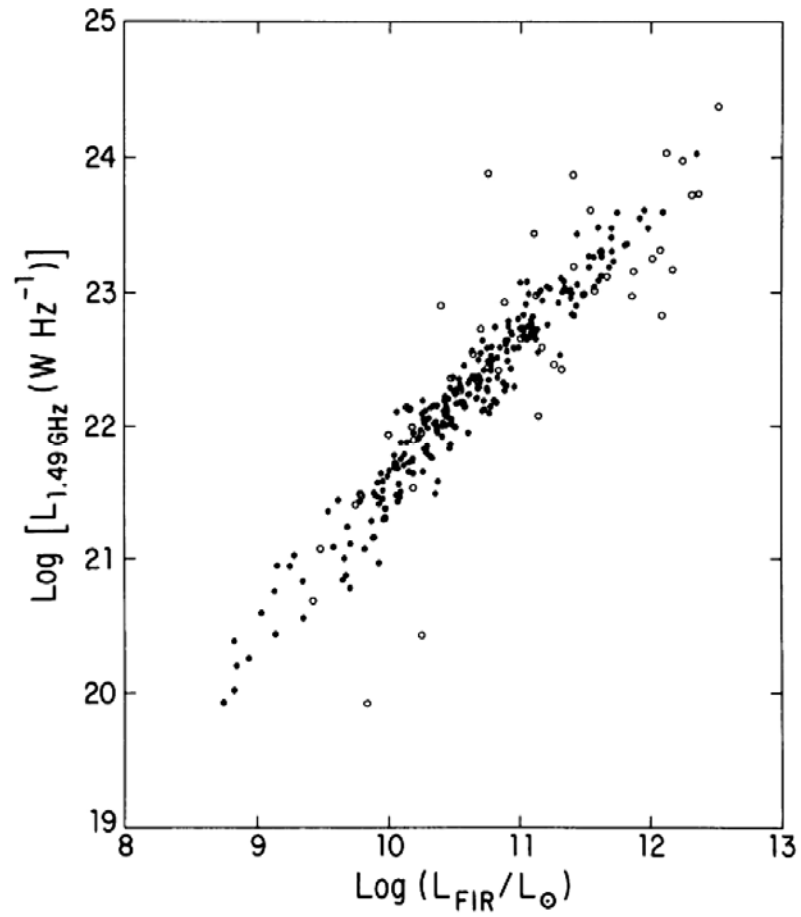
polarized emission from interarm regions: NGC 6946



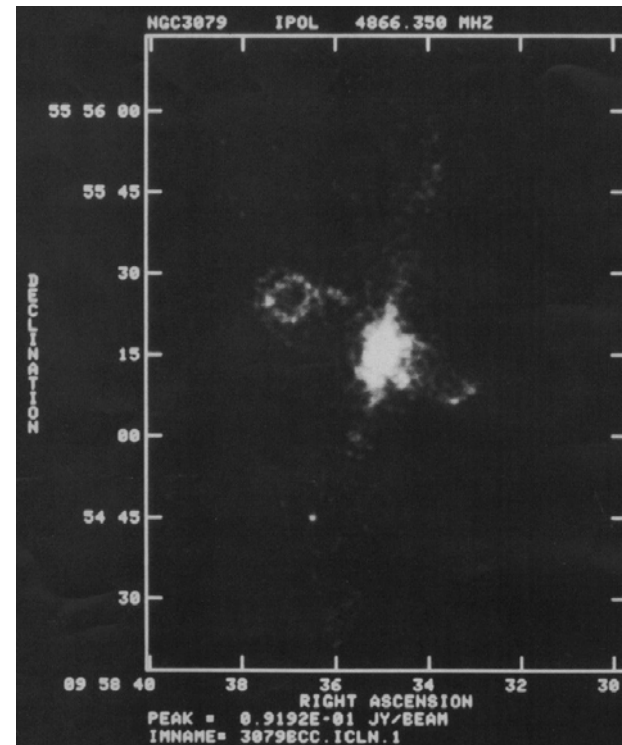
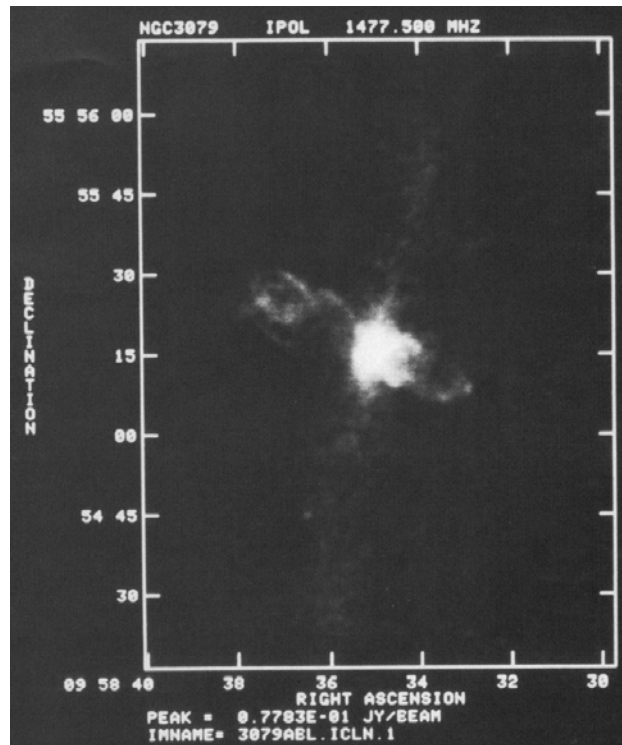
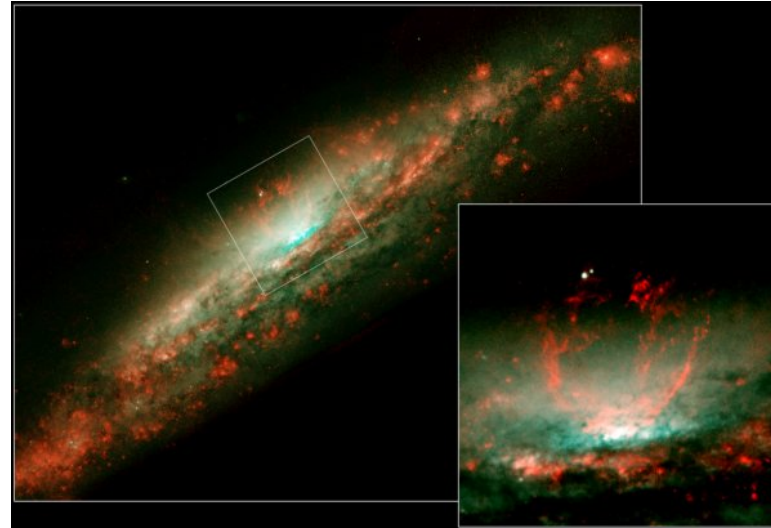
M 82: outflow ($H\alpha$), radio continuum, B-field



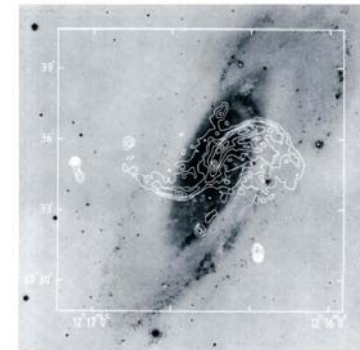
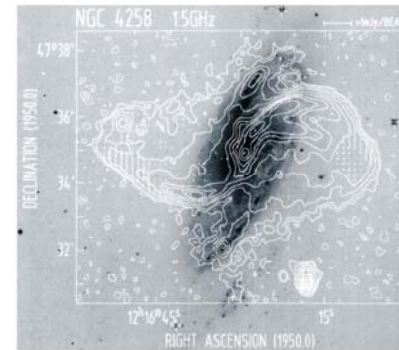
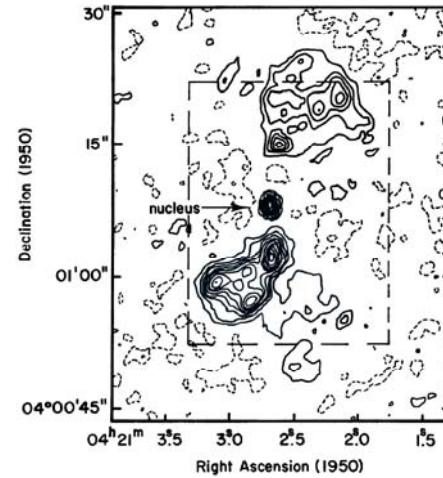
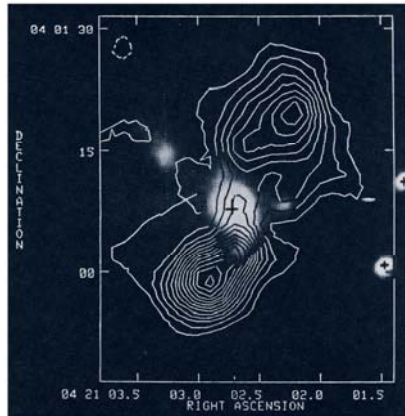
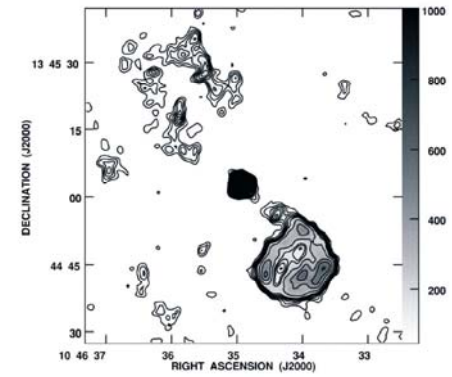
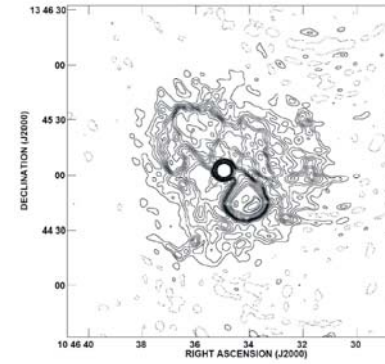
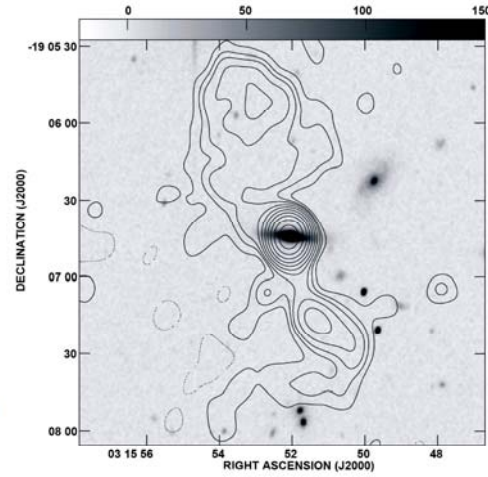
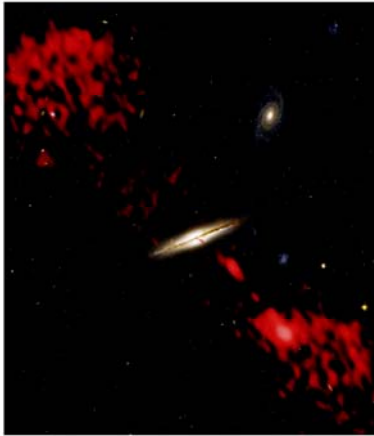
radio-FIR correlation



NGC 3079: birth of pre-AGN?

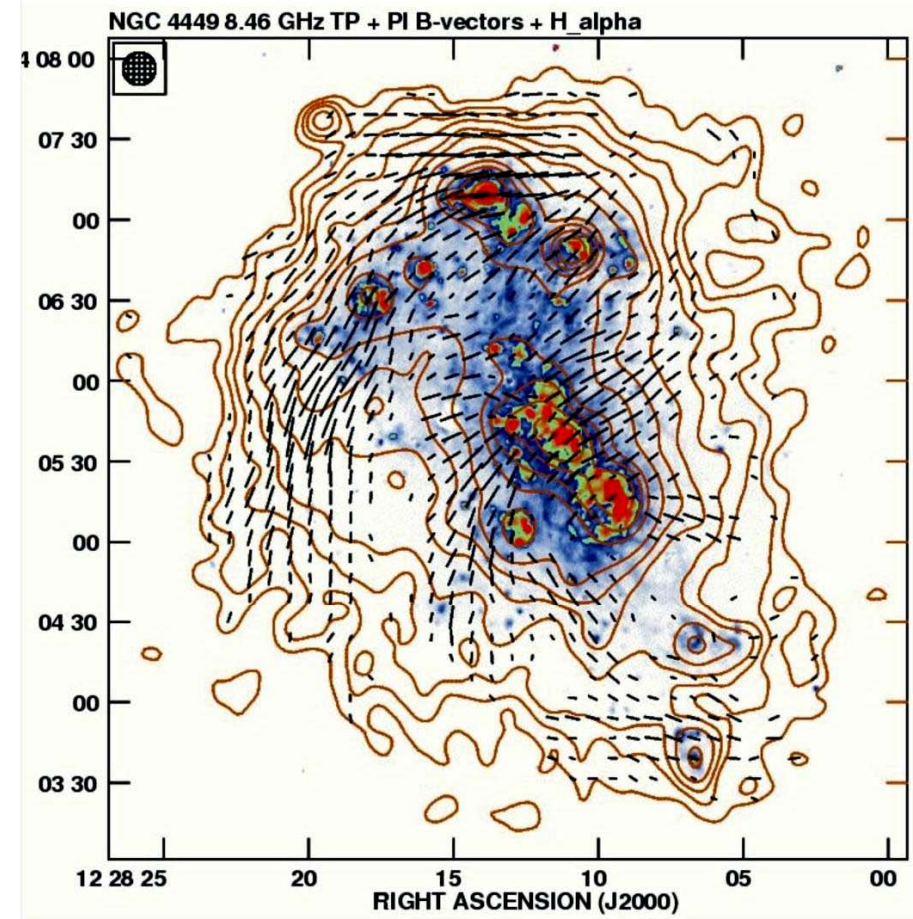
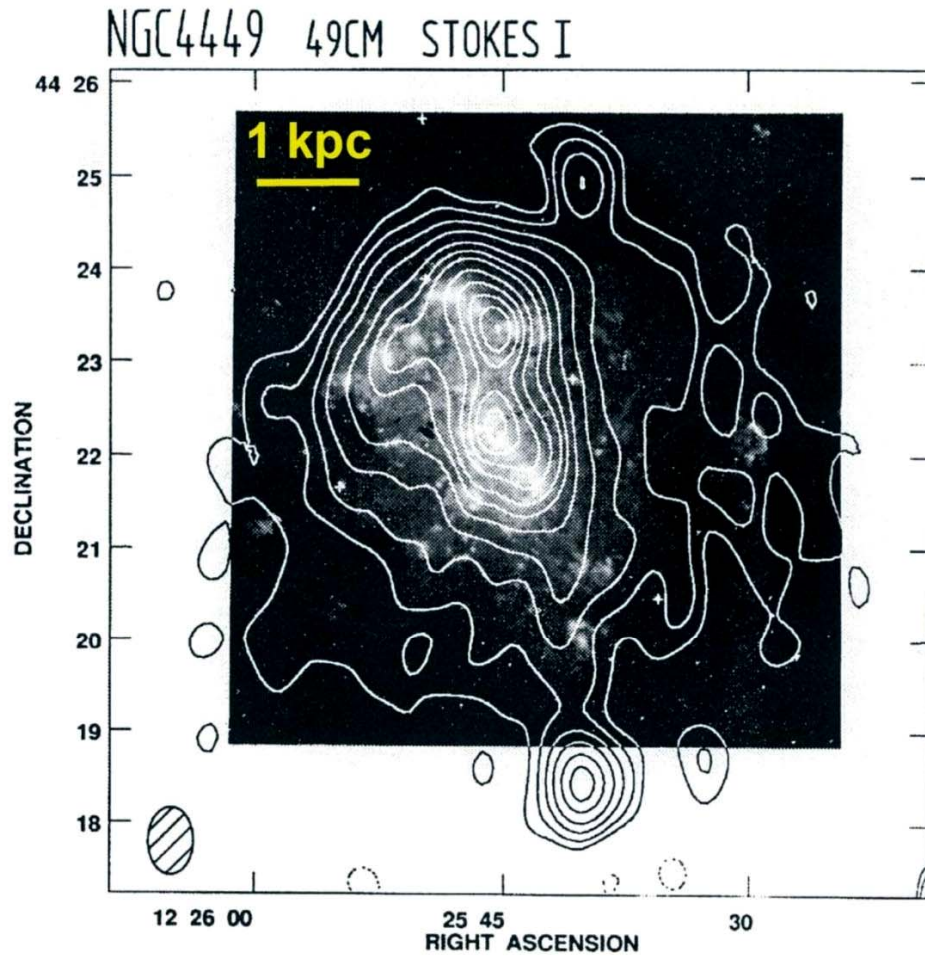


spiral galaxies with AGN

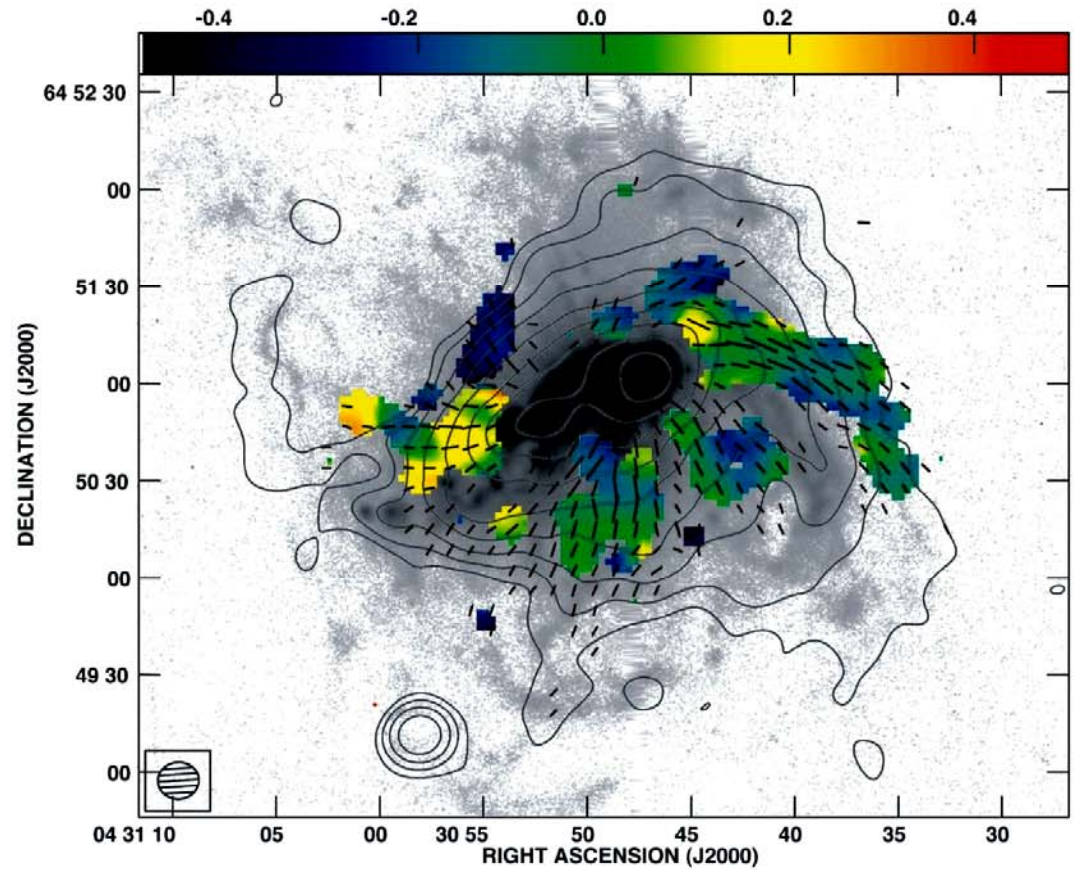
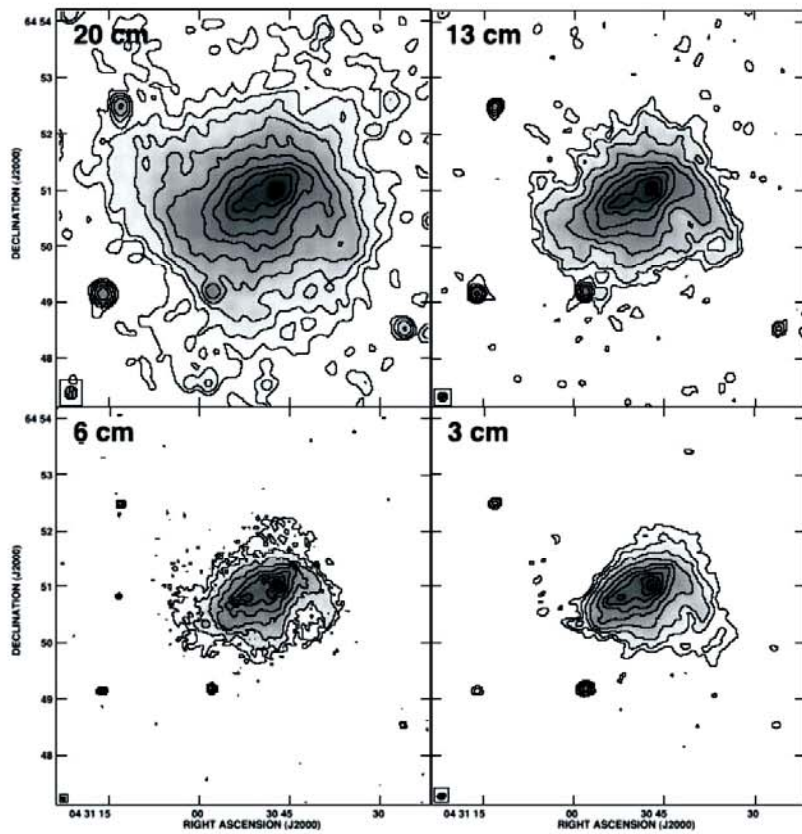


Dwarf galaxies

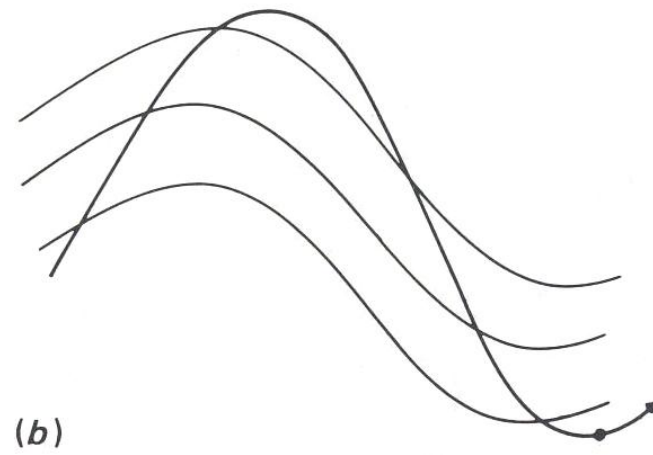
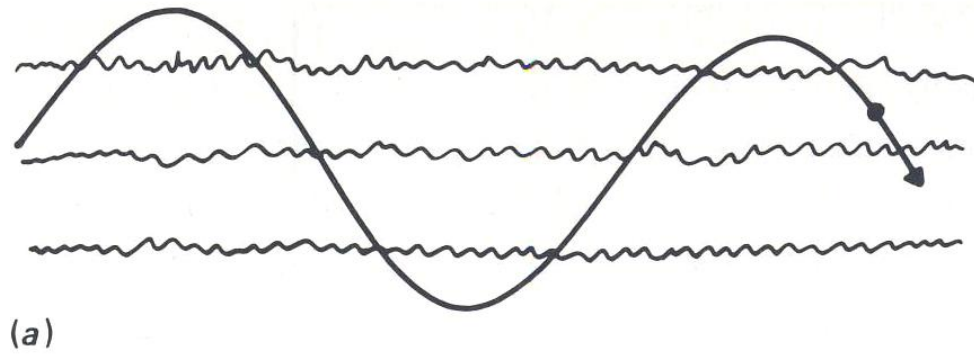
NGC 4449



NGC 1569

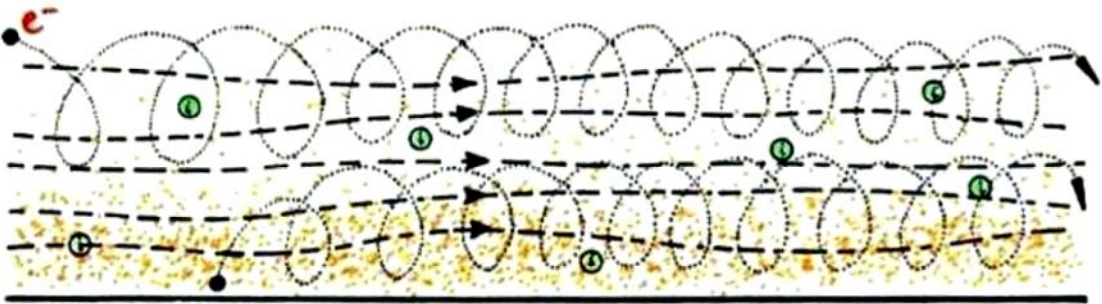


pitch-angle scattering

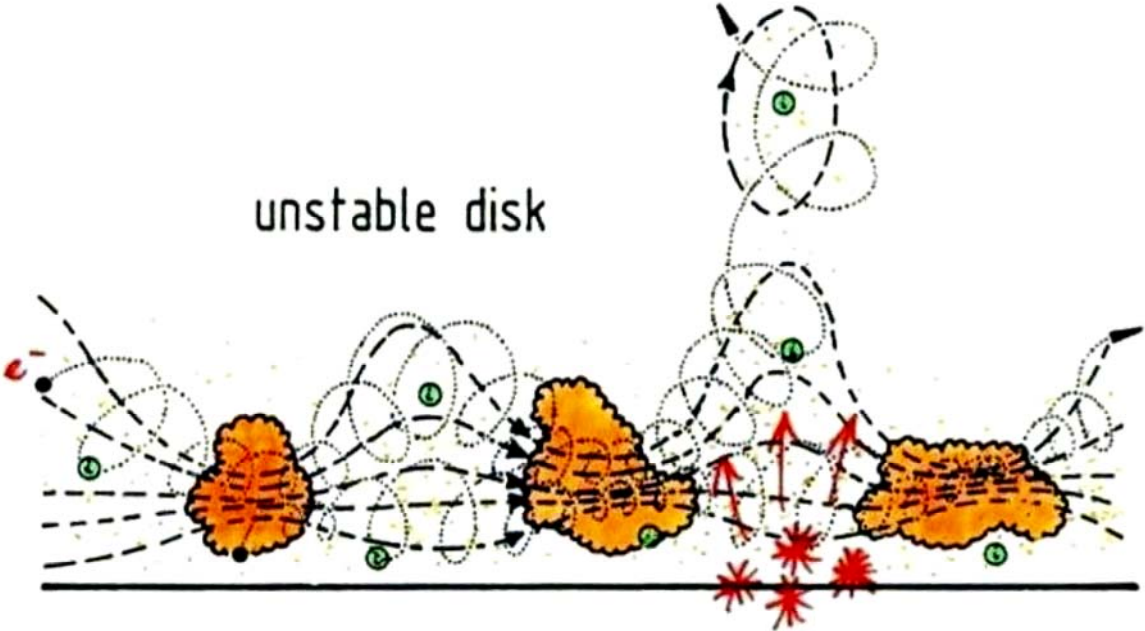


Cosmic-ray containment

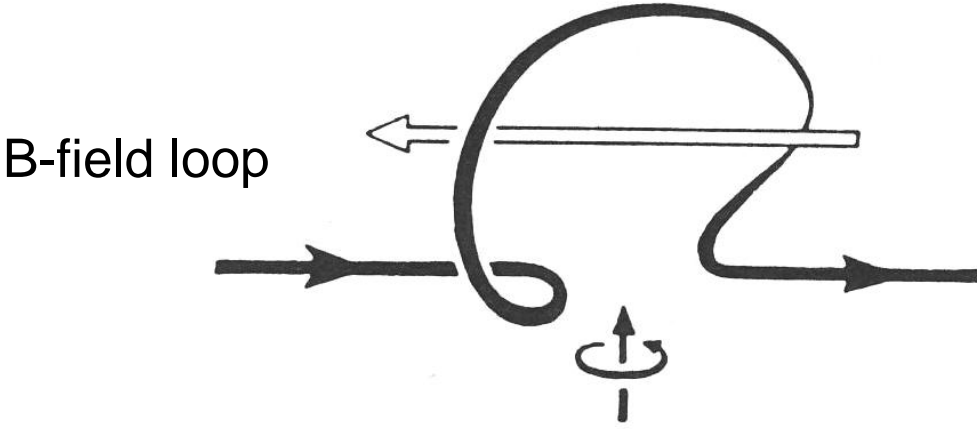
stable disk



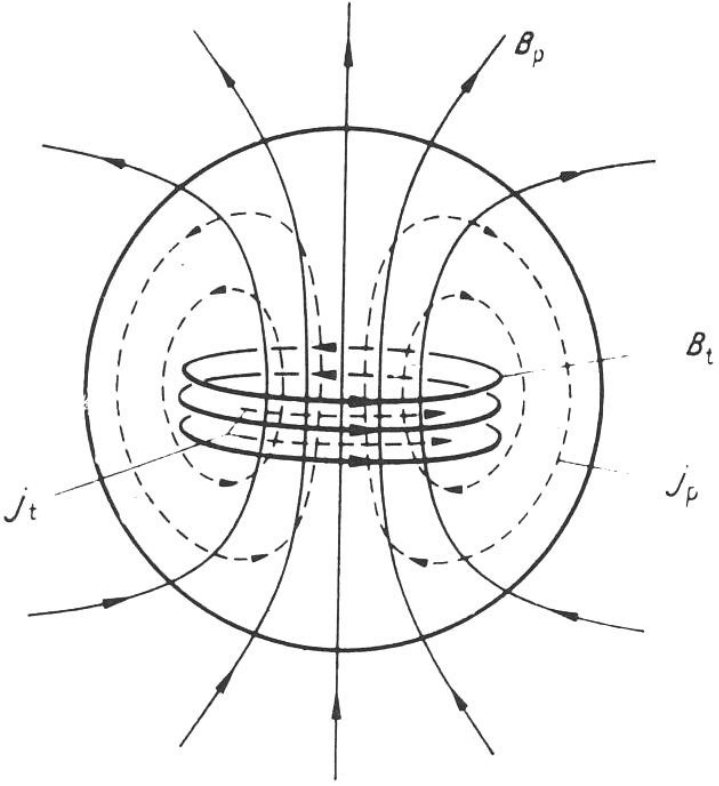
unstable disk



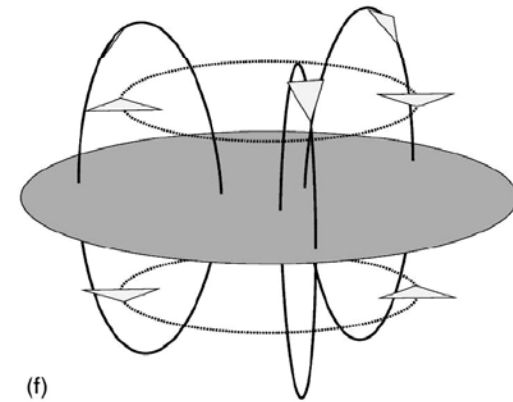
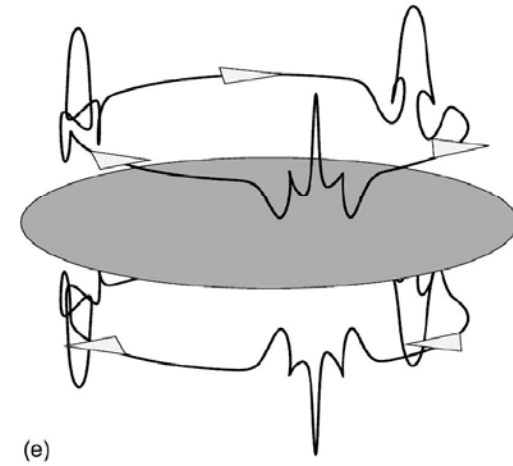
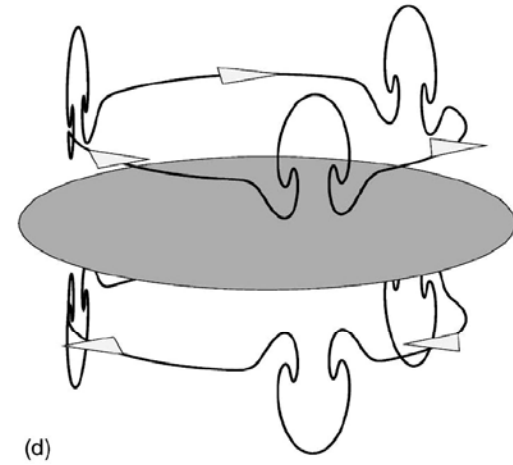
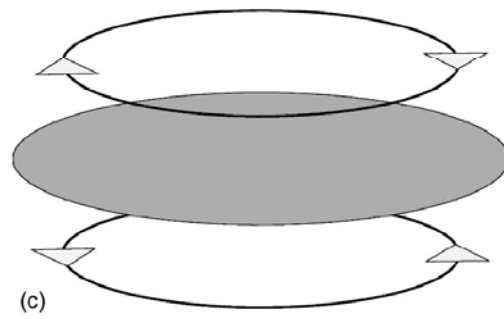
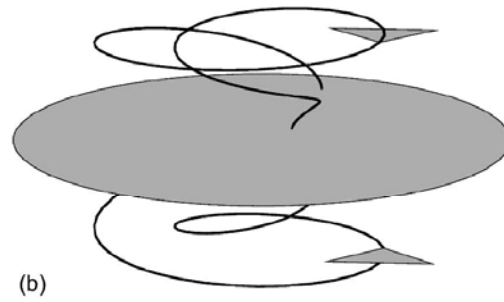
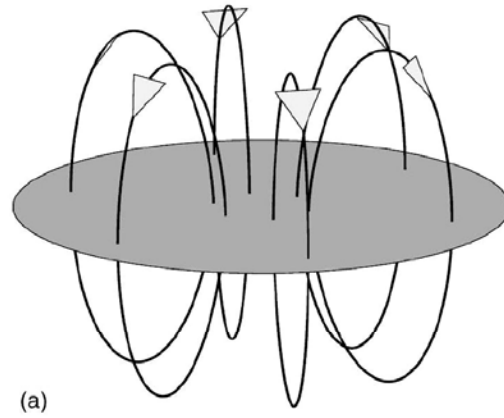
Dynamos:



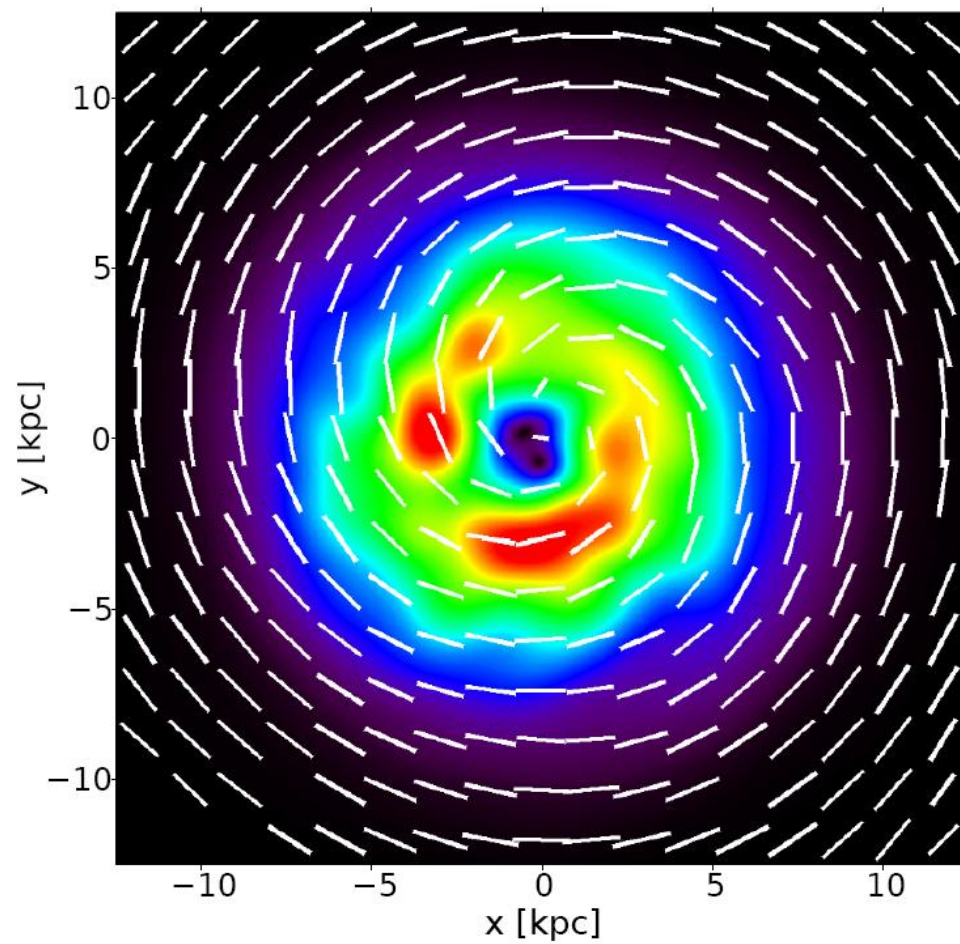
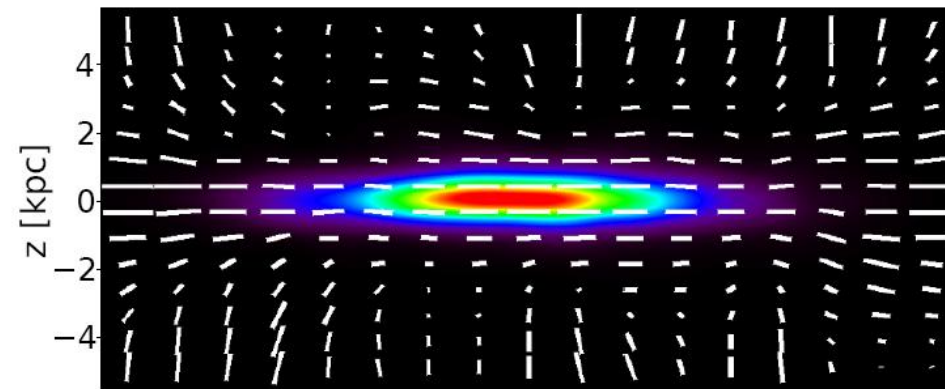
principle of solar dynamo



galactic dynamo



MHD simulations of
CR-driven dynamo



Spaghetti diagramme from MHD simulations of CR-driven dynamo

