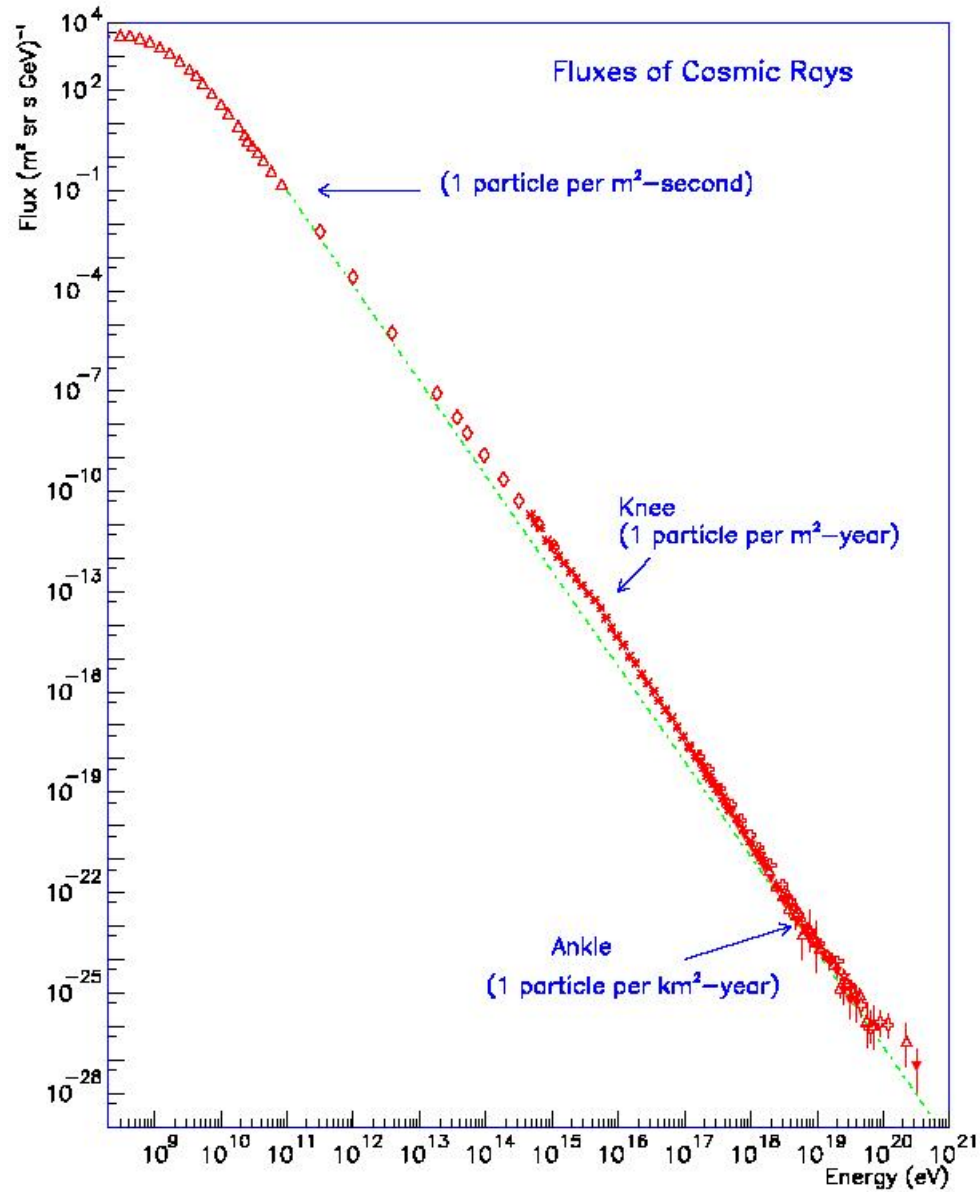
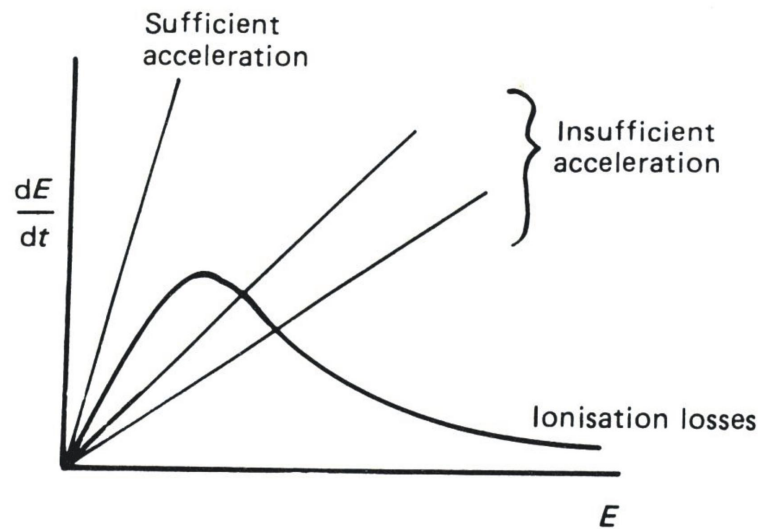
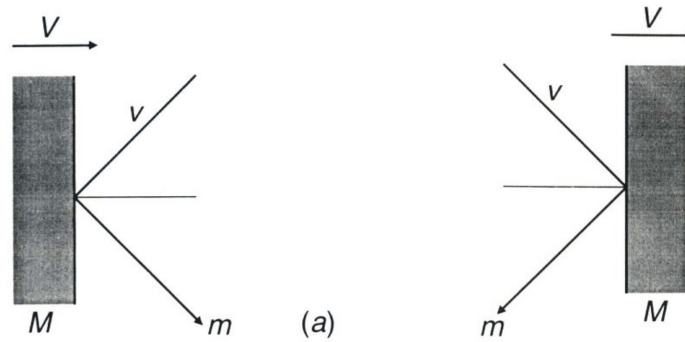

Cosmic Rays

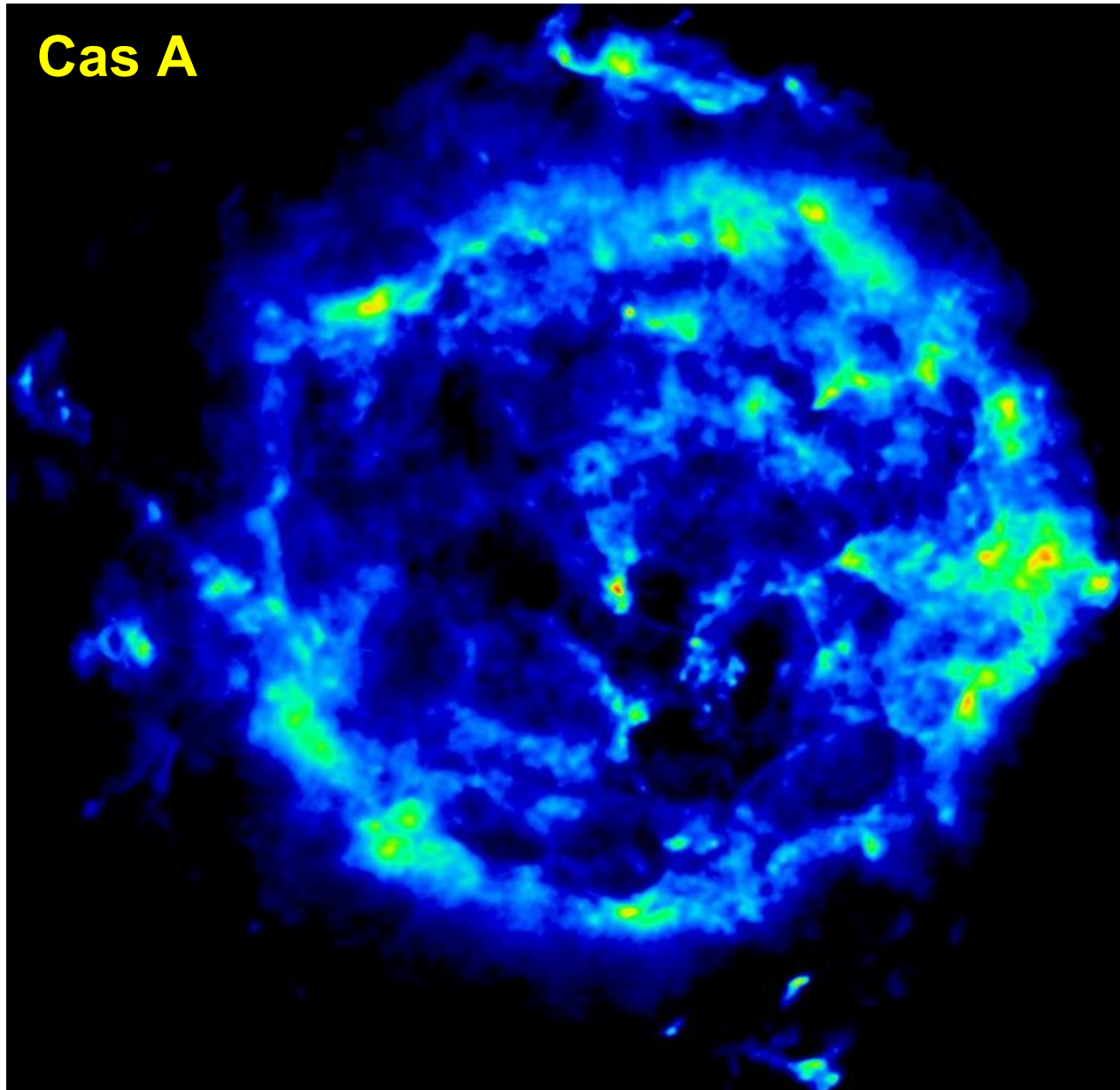
CR spectrum



2nd-order Fermi acceleration



Accelerators: SNR



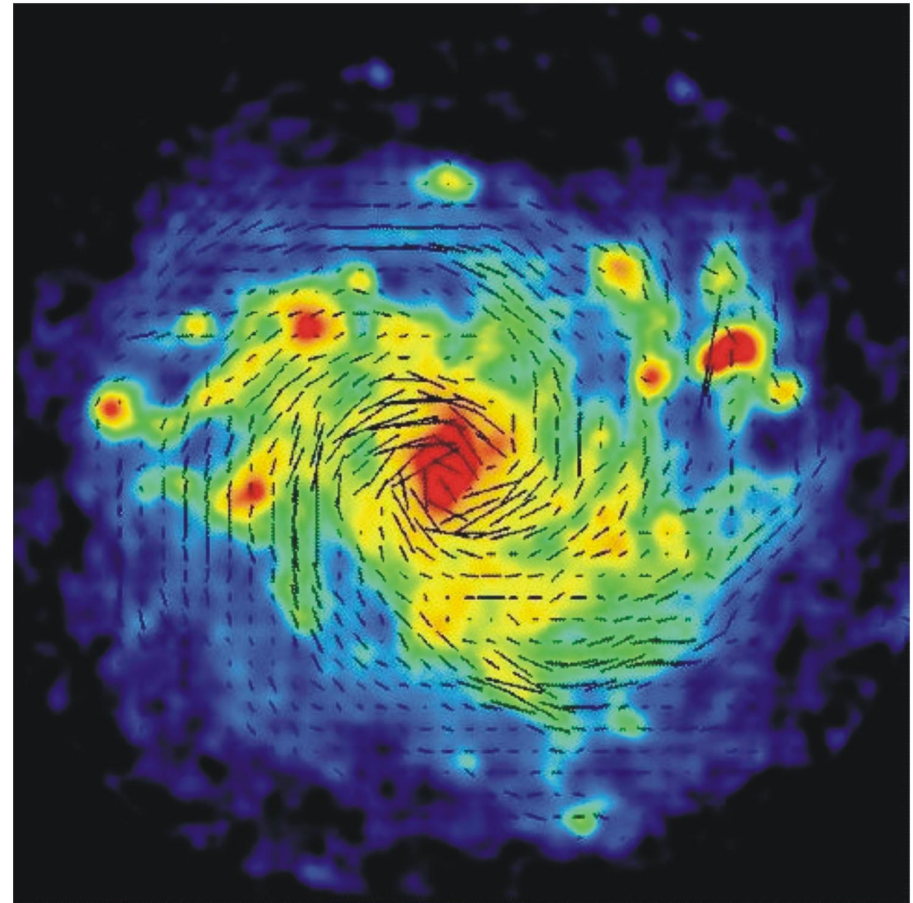
Accelerators: SNR

Spiral galaxy NGC 6946

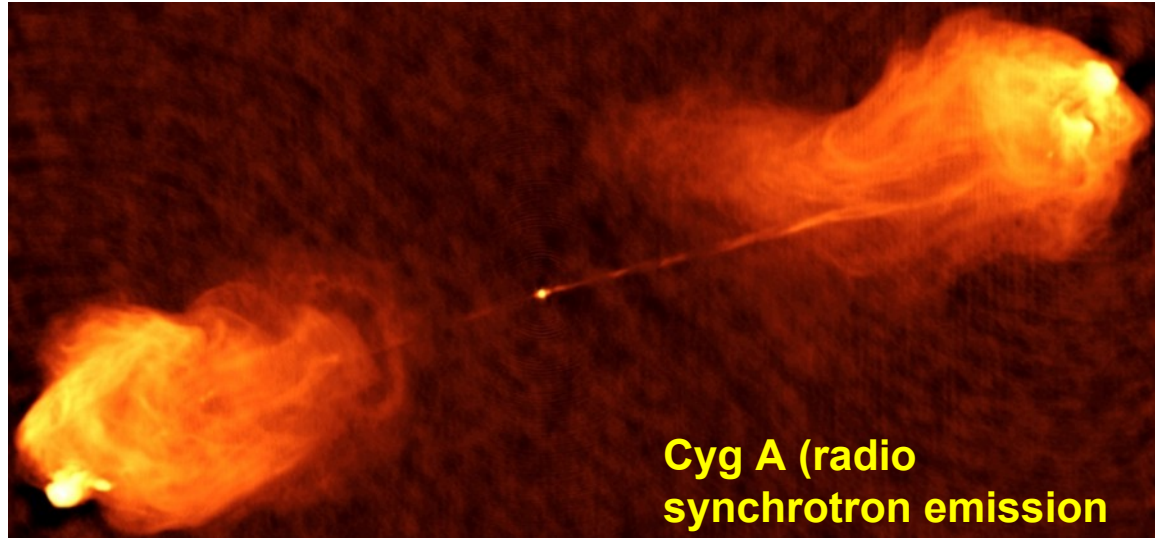
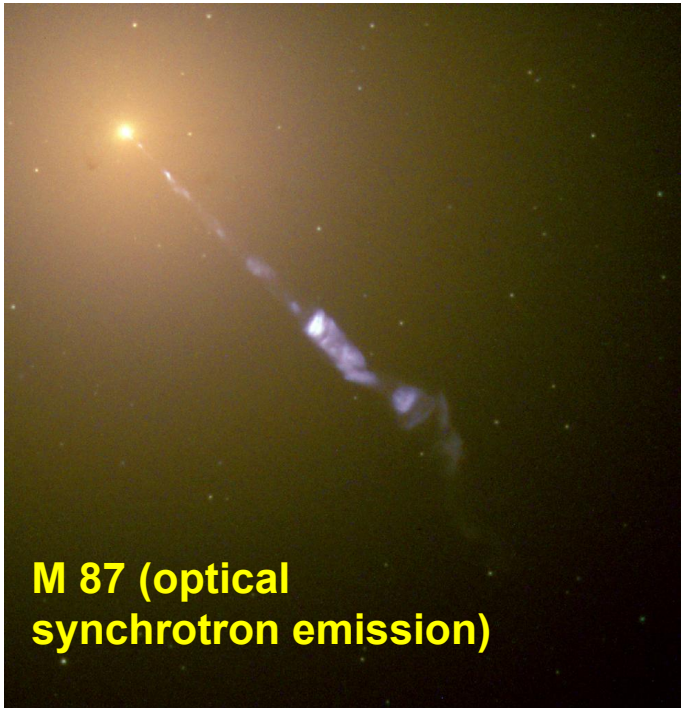
optical



radio

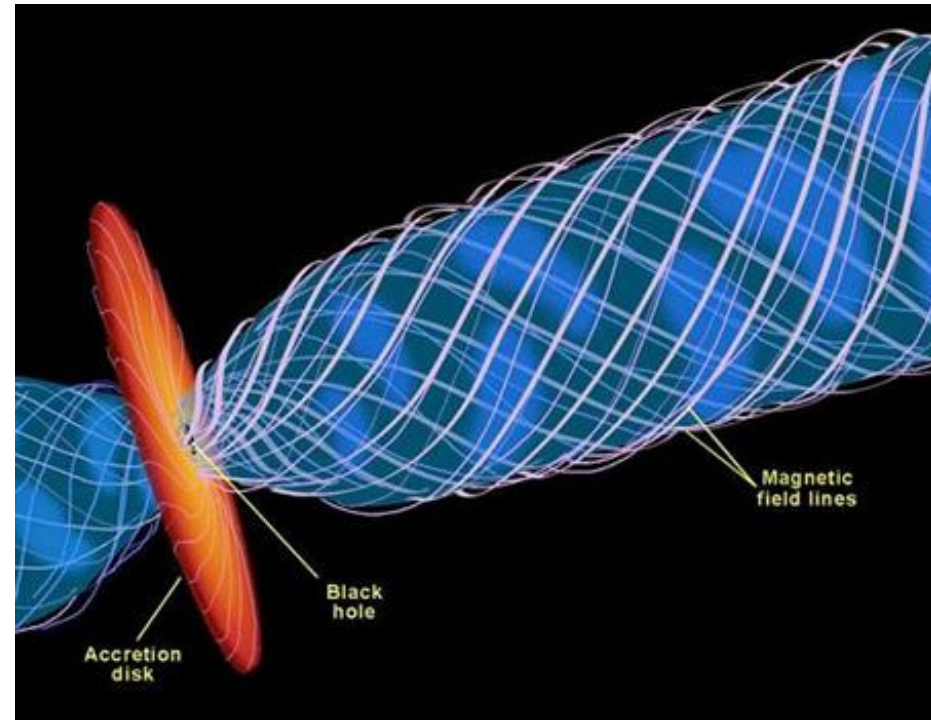
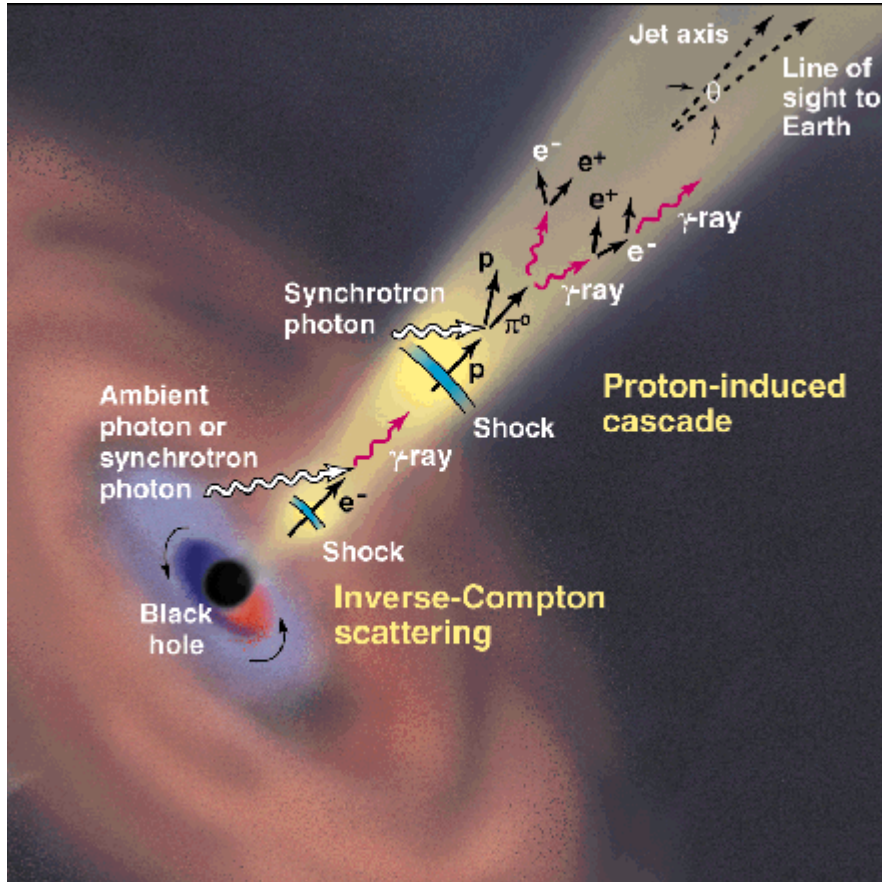


Accelerators: AGN

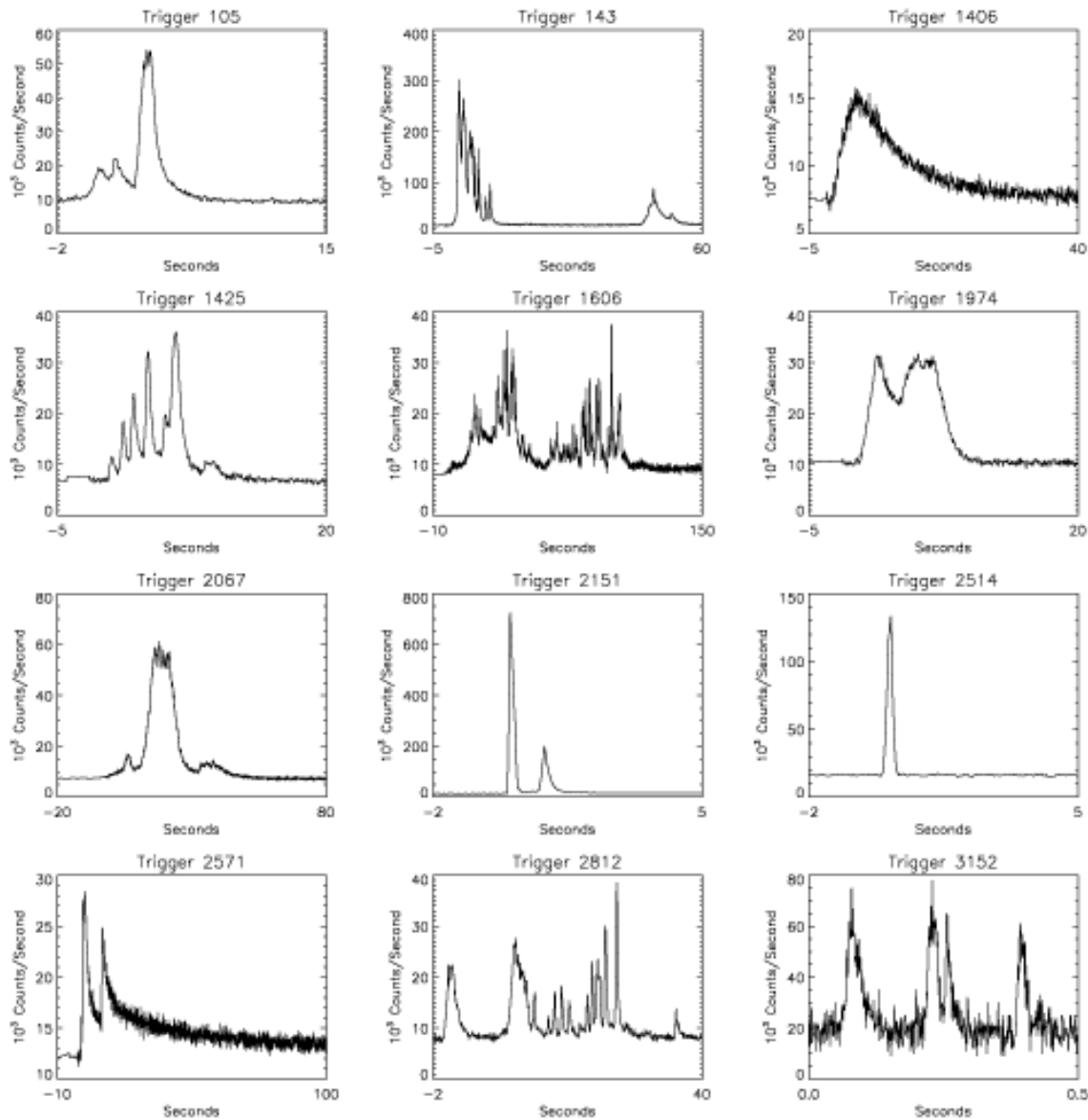


Accelerators: AGN

Magnetic field twisting and particle acceleration in jets



Accelerators: GRBs

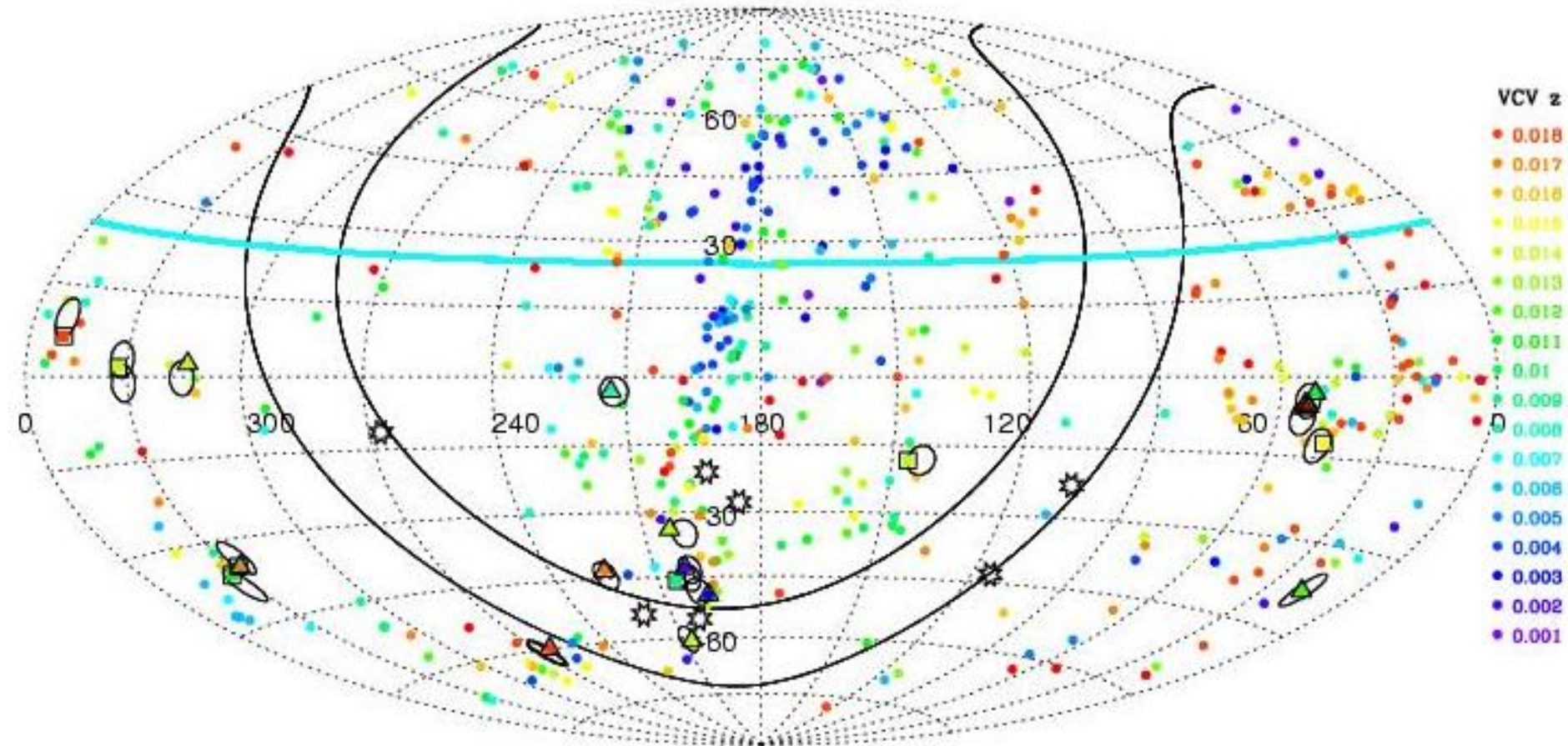


recorded γ -ray bursts

UHECRs: sources

					protons ($\eta_a = 0.1$)	electrons ($\eta_a = 10^{-4}$)	
	B	R	Γ	ϵ_{cl}	ϵ_{syn}	ϵ_{syn}	Remark
SNRs	10^{-6} G	10 pc	1	10^{15} eV	large	10^{14} eV	Radio synchr. Gamma SSC
AGNs							
-Nucleus	10^3 G	10^{-4} pc	1	10^{19} eV	10^{18} eV	10^{10} eV	$p\gamma$ -process $\tau_{\gamma\gamma} > 1$
-Relat. Jets	1 G	10^{-3} pc	10	10^{18} eV	10^{20} eV	10^{13} eV	$p\gamma$ -process Gamma SSC
-Hot Spots	10^{-4} G	10^3 pc	1	10^{19} eV	large	10^{14} eV	Radio synchr. X-rays SSC
-Radio Lobes	10^{-6} G	10^6 pc	1	10^{20} eV	large	10^{15} eV	Radio synchr.
GRBs	10^3 G	10^{-5} pc	10^3	10^{21} eV	10^{22} eV	10^{13} eV	$p\gamma$ -process Gamma SSC
Large cosm. Structures	10^{-7} G	10^7 pc	1	10^{20} eV	large	10^{16} eV	t_a quite long
Pulsar Winds	10^{-5} G	10^{-3} pc	10^6	10^{17} eV	large	large	Synchr. Radio-X
Plerions							SSC

UHECRs: correlations



Circles : correlation within 3.2°

Stars : no correlation

Triangles : AGN

Squares : starburst galaxy

Dots : uncorrelated galaxy in catalogue

Black solid lines mark Galactic plane, where galaxy catalogues is incomplete