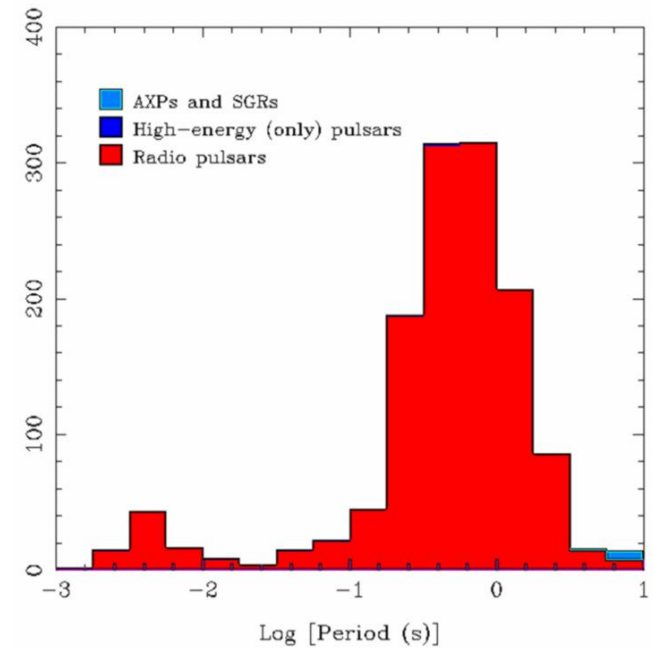
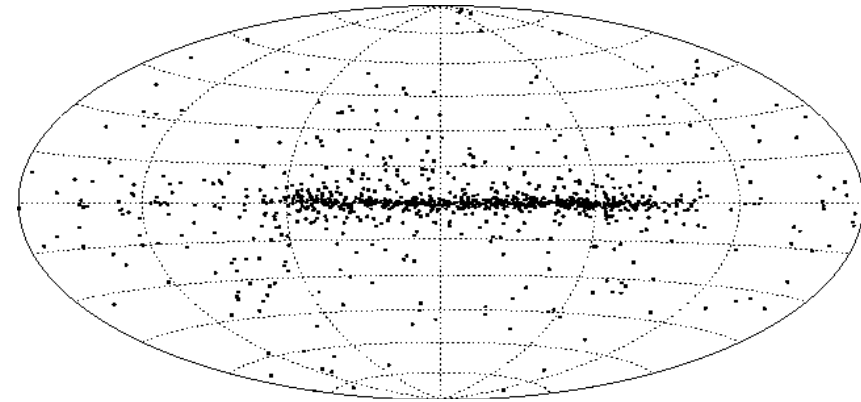
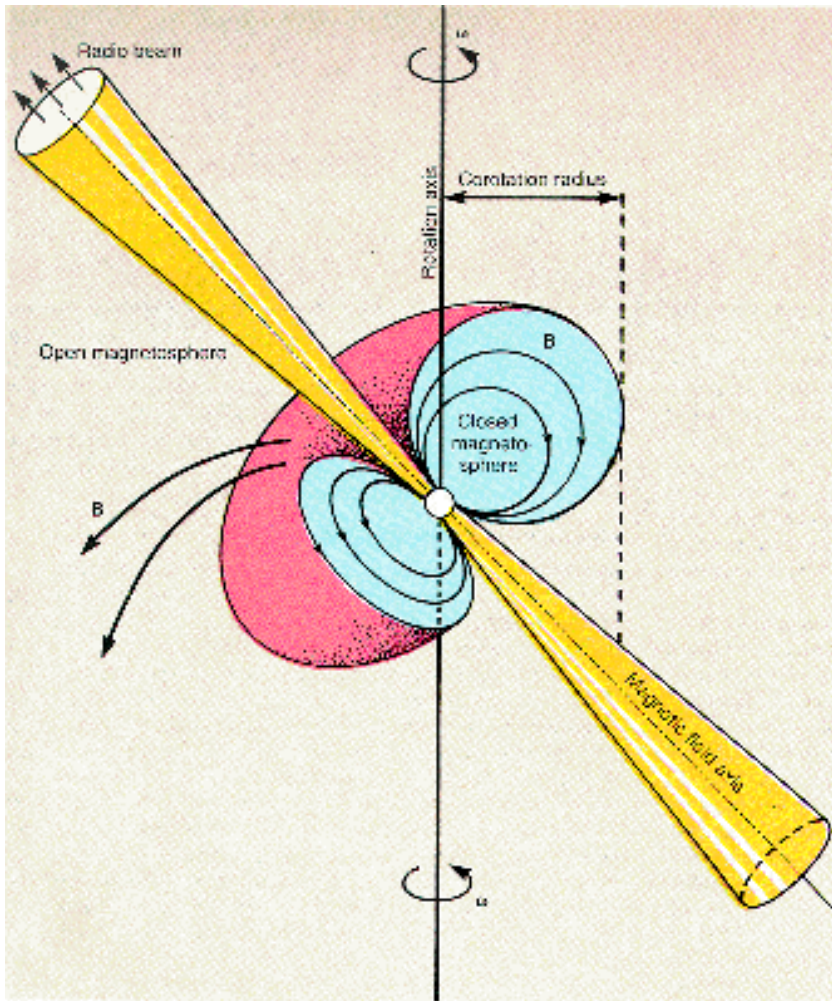
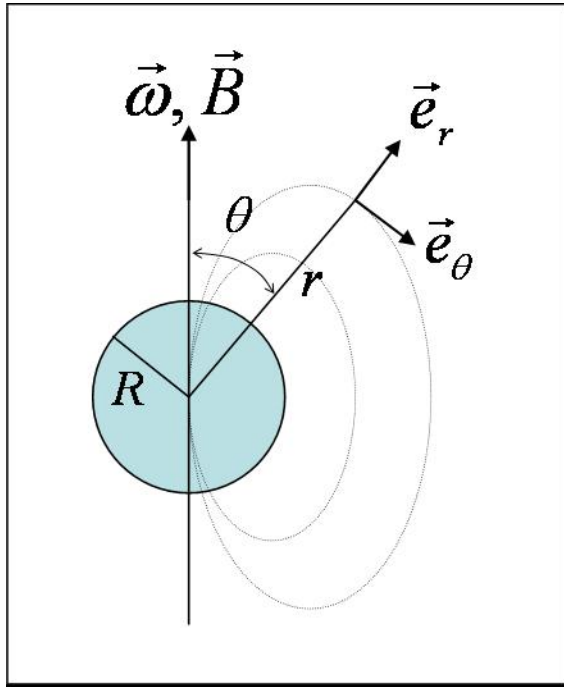


Pulsare

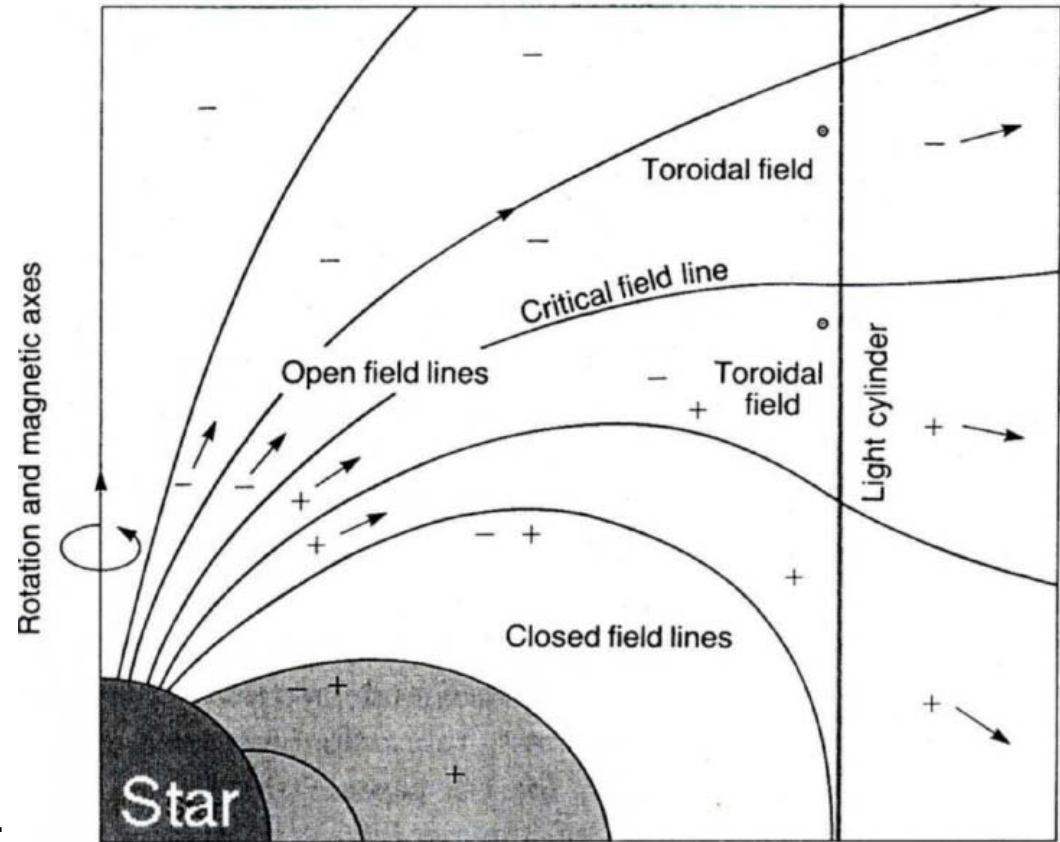


Goldreich-Julian-Modell (,aligned rotator‘)



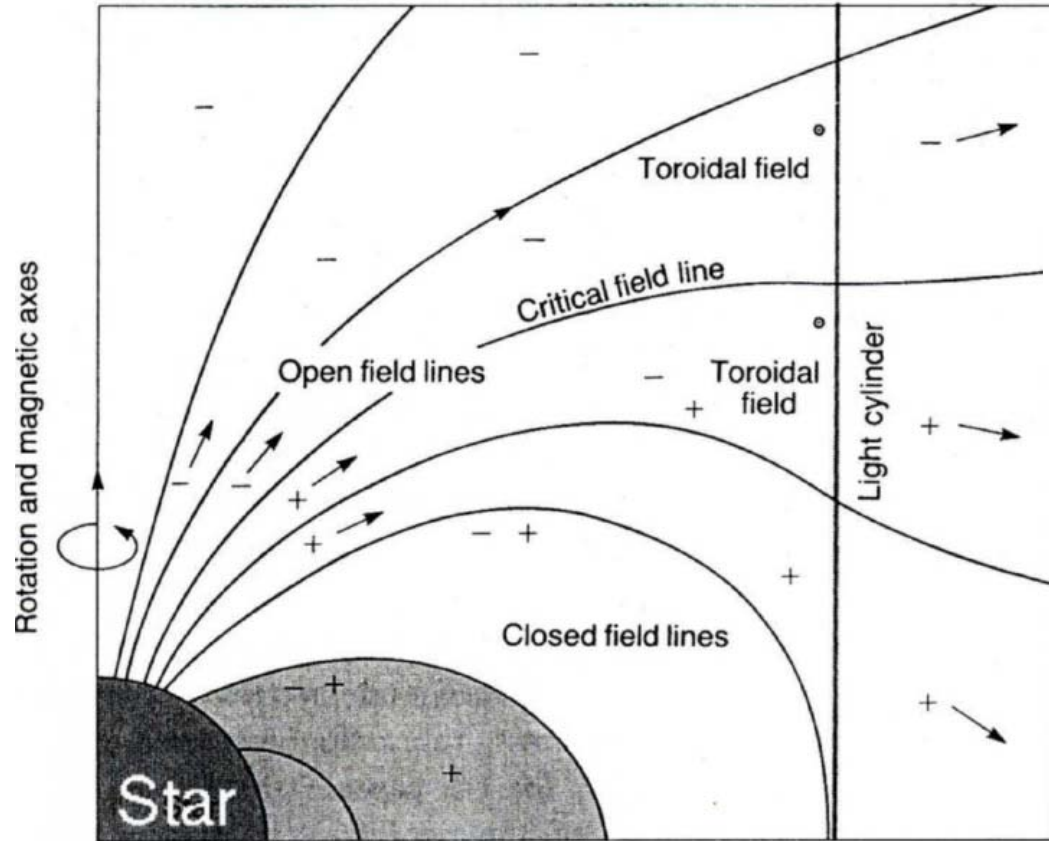
Gleichgewicht zwischen
Lorentz-Kraft und Induziertem Feld:

$$\vec{E}_{ind} = -\vec{v} \times \vec{B} = -(\vec{\omega} \times \vec{r}) \times \vec{B}$$



$$E_{||,ind} = O(10^{12} \text{ V/m})$$

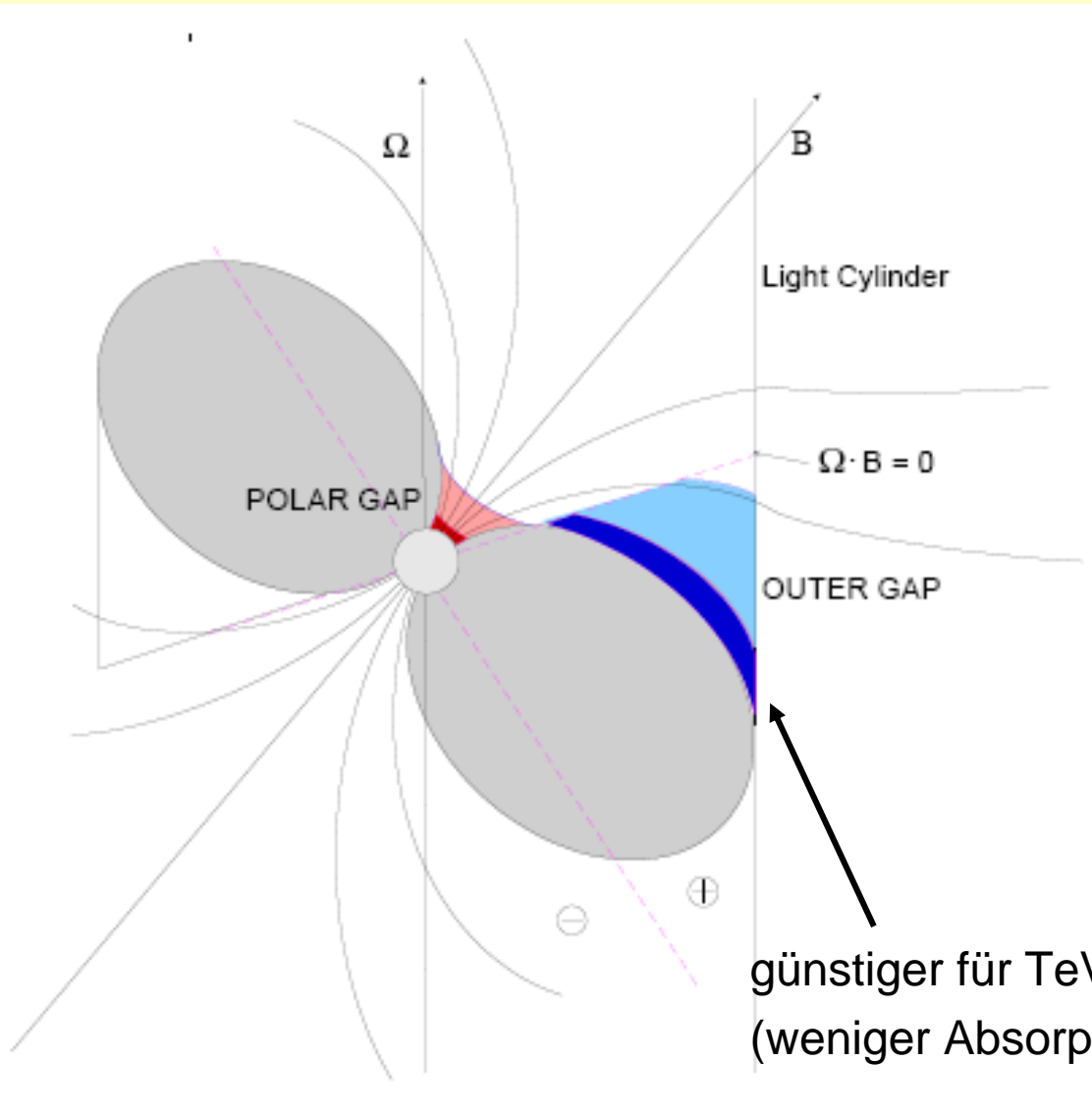
Goldreich-Julian-Modell



$$\rho_{GJ} = \epsilon_0 \nabla \cdot \vec{E}_{ind} = -2 \epsilon_0 \vec{\omega} \cdot \vec{B}$$

$$v = r\omega = c \implies R_{lc} = \frac{c}{\omega} = 4.8 \cdot 10^4 \text{ km} \left(\frac{T}{1 \text{ s}} \right)$$

„non-aligned rotator“: Polar Cap vs. Outer Gap Models



grobe Abschätzung:

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

typische Länge L

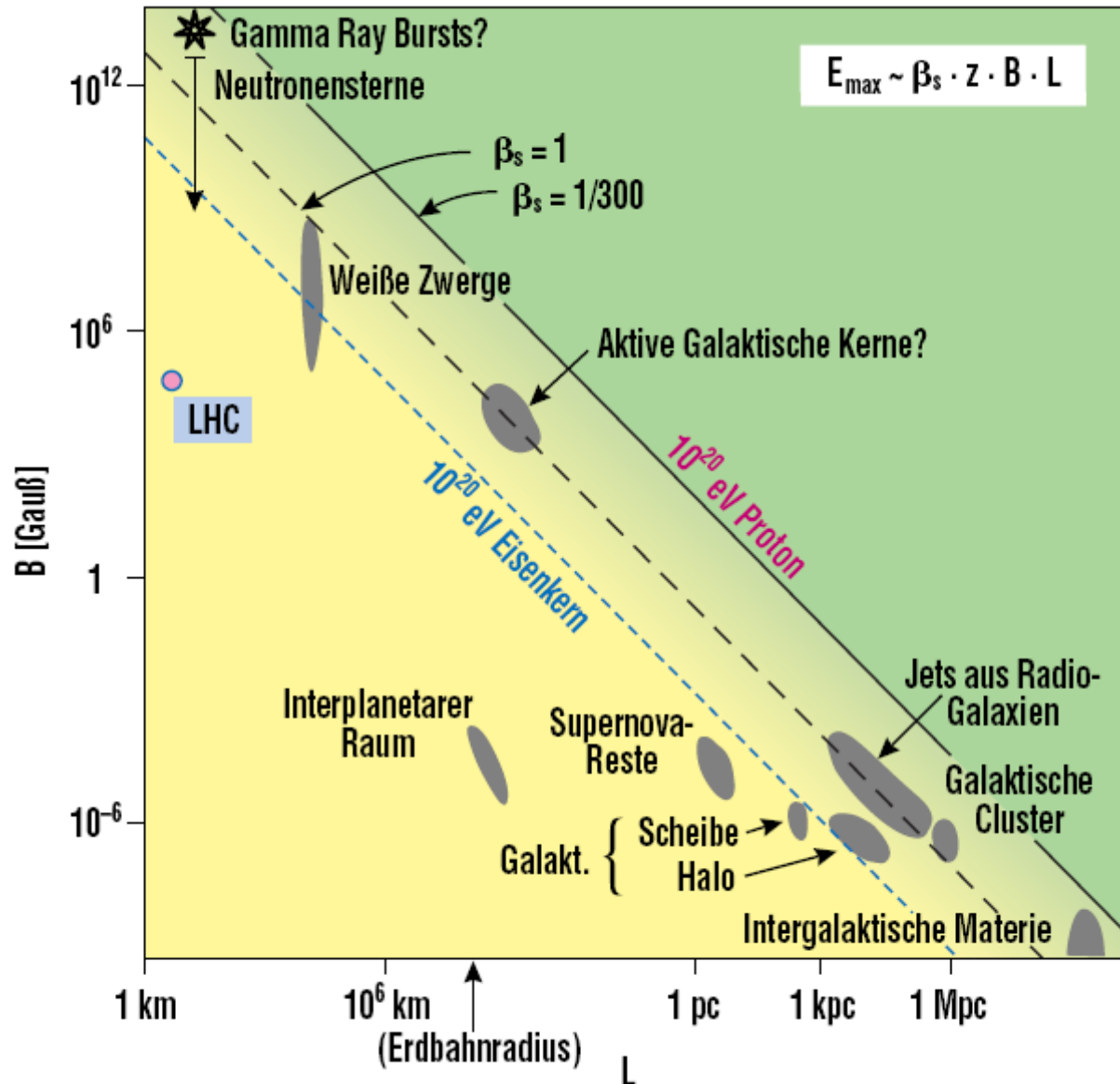
$$\epsilon_{max} = \int_0^L e E ds = e B c L$$

$$B = 10^6 \text{ T und } L = 100 \text{ km}$$

$$\epsilon_{max} = 3 \cdot 10^{19} \text{ eV}$$

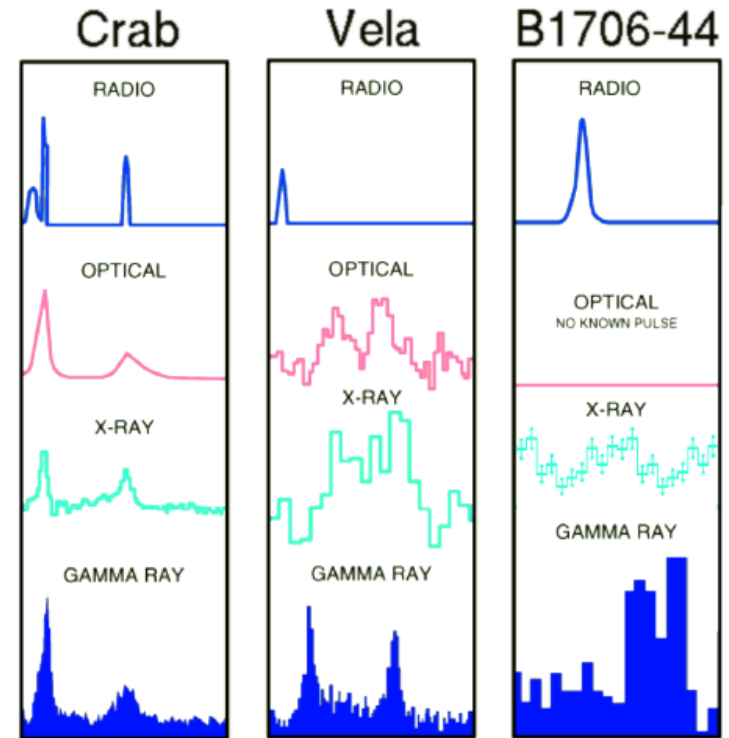
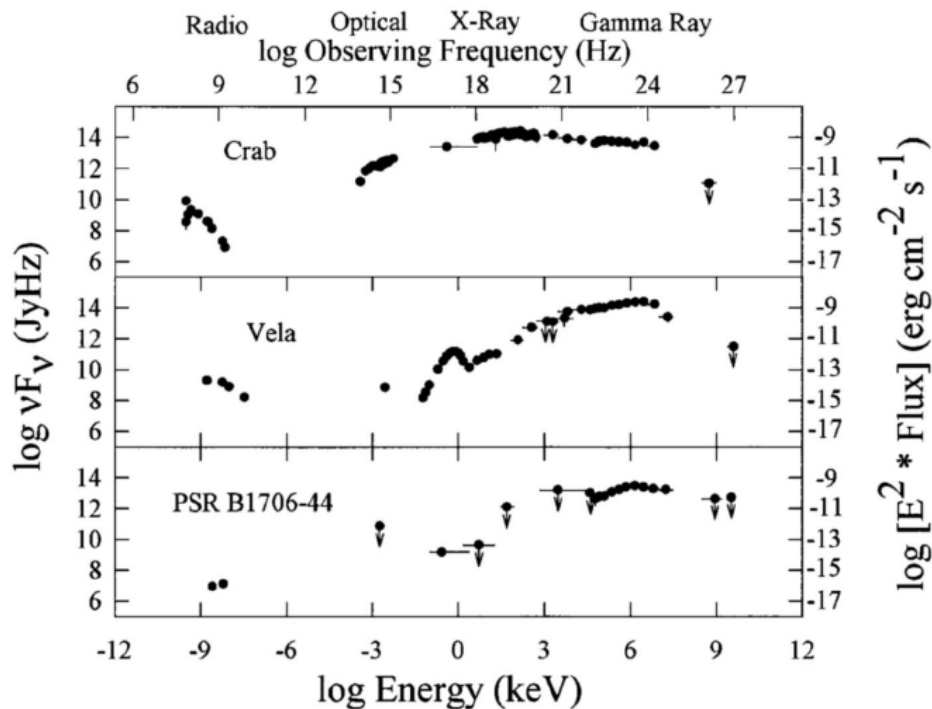
günstiger für TeV-Gammas
(weniger Absorption)

Hillas-Diagramm

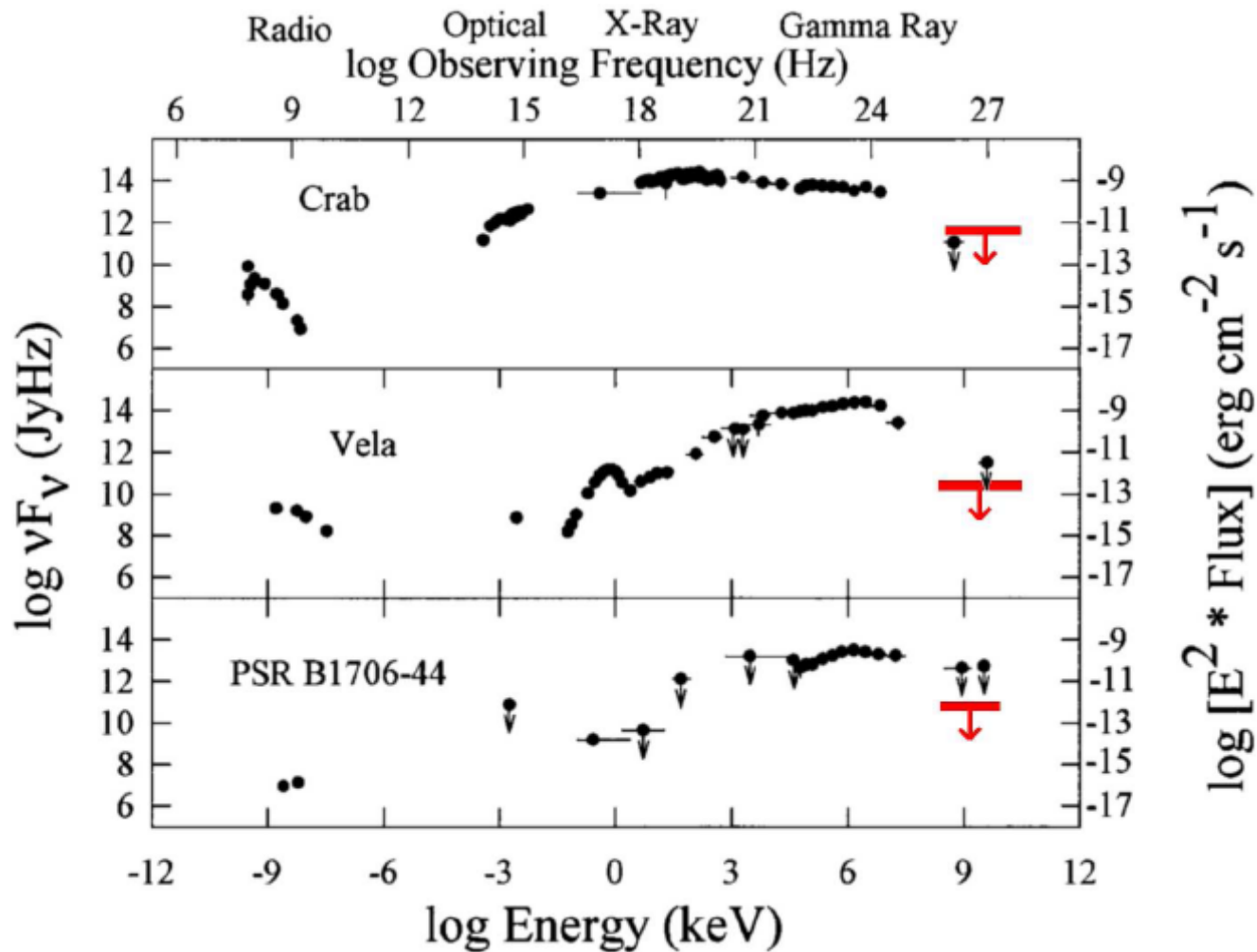


Pulsar-Spektren und -Lichtkurven

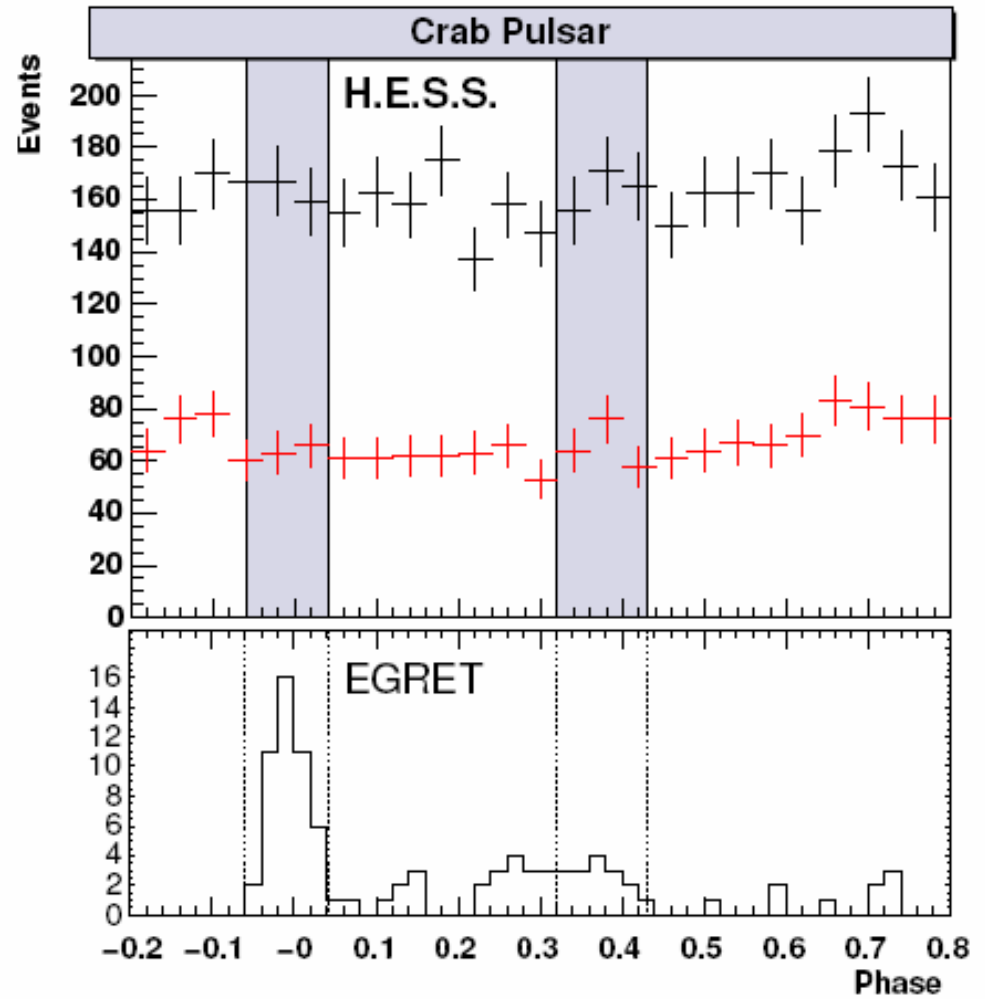
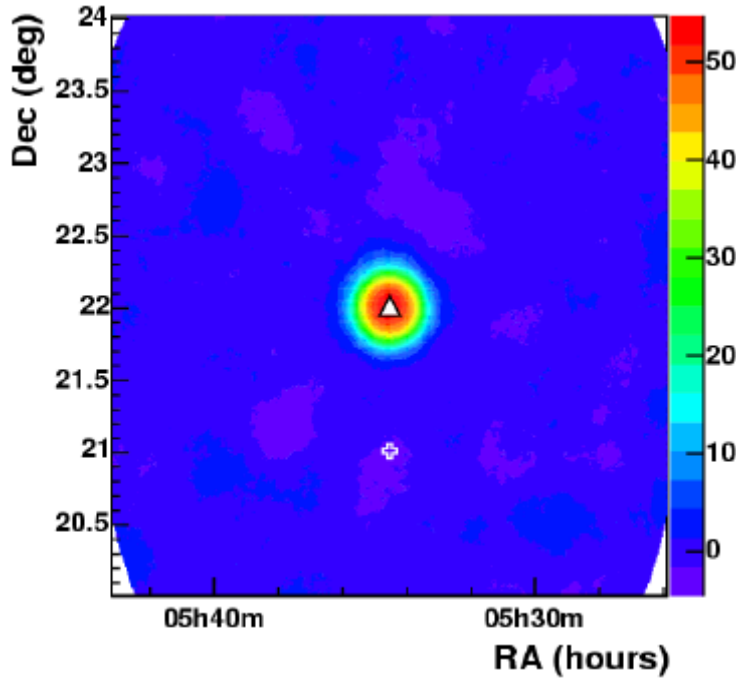
	P [ms]	τ [yr]	d [kpc]	B_0 [10^{12} G]	\dot{E}_{sd} [erg s^{-1}]
Crab	33.6	1,300	2.0	3.8	$4.5 \cdot 10^{38}$
Vela	89.3	11,000	0.3	3.3	$7.0 \cdot 10^{36}$
PSR B1706-44	102.5	17,000	1.8	3.1	$3.4 \cdot 10^{36}$



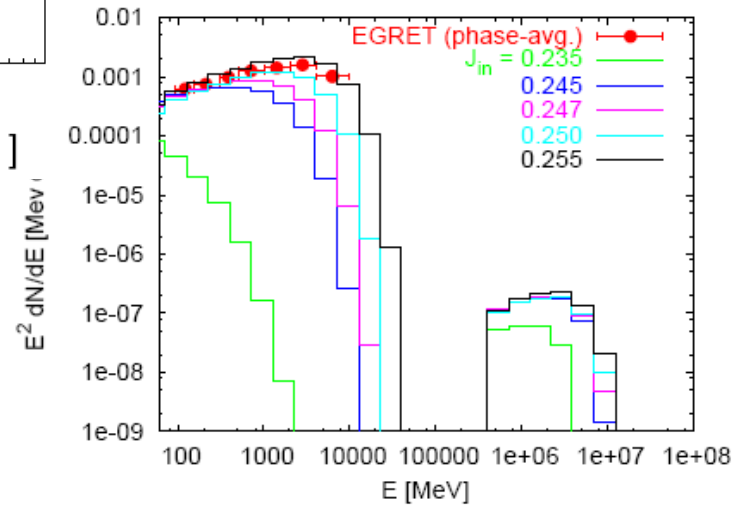
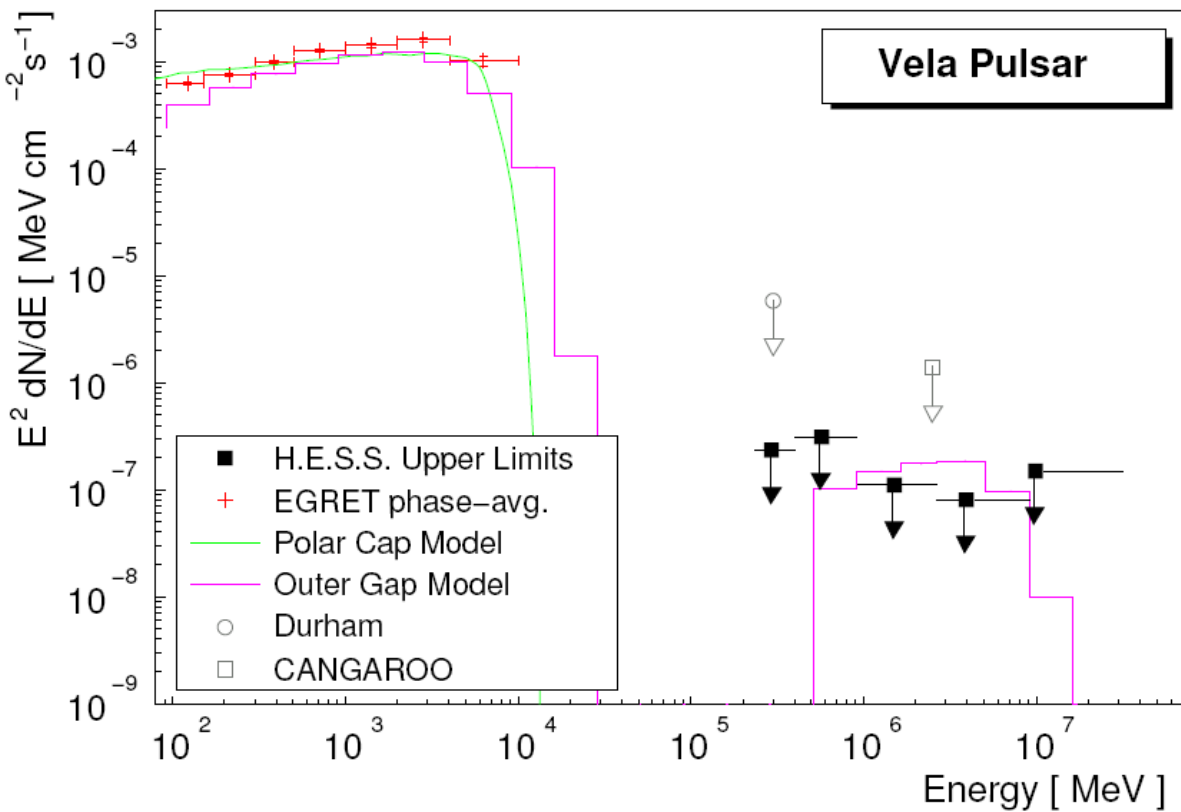
Grenzen für gepulste TeV-Starhlung



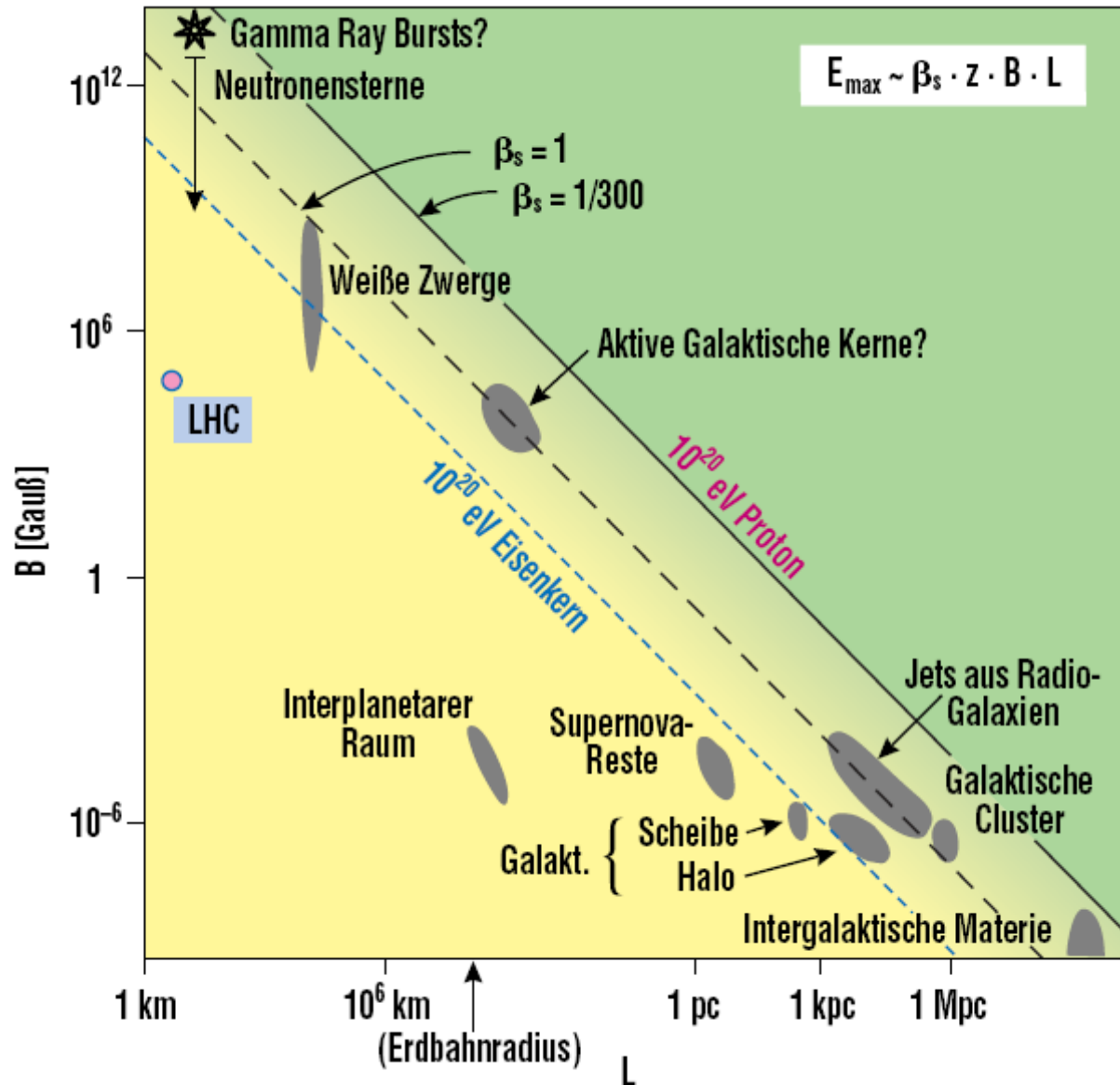
Krebs-Phasogramm



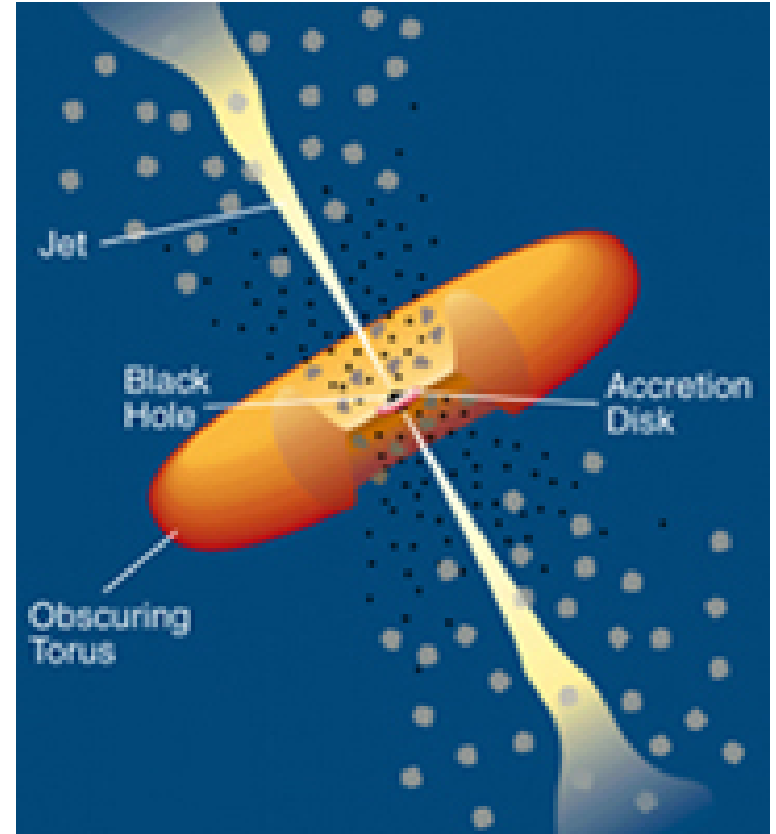
Gemessene TeV-Spektren



Hillas-Diagramm

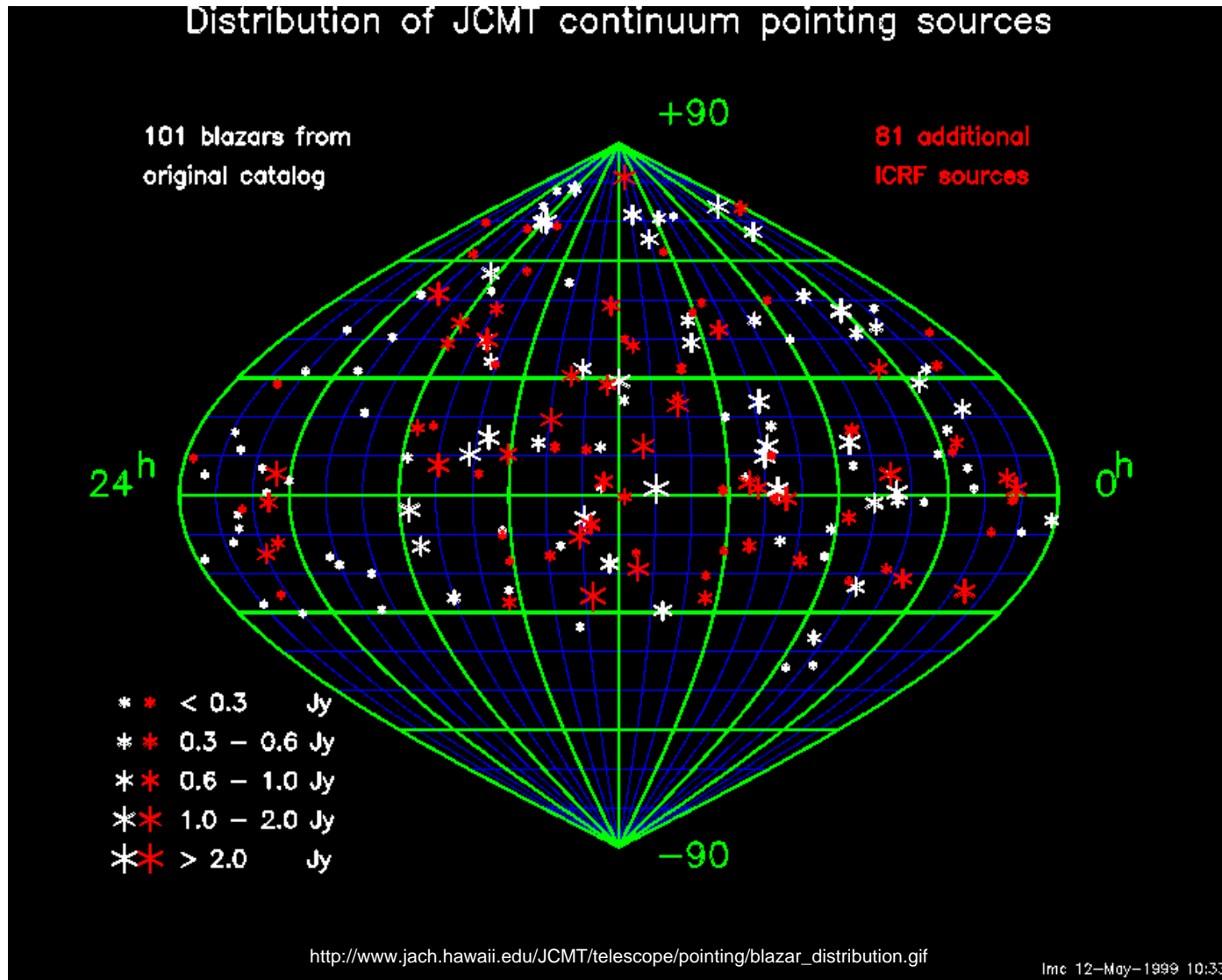


Aktive Galaktische Kerne

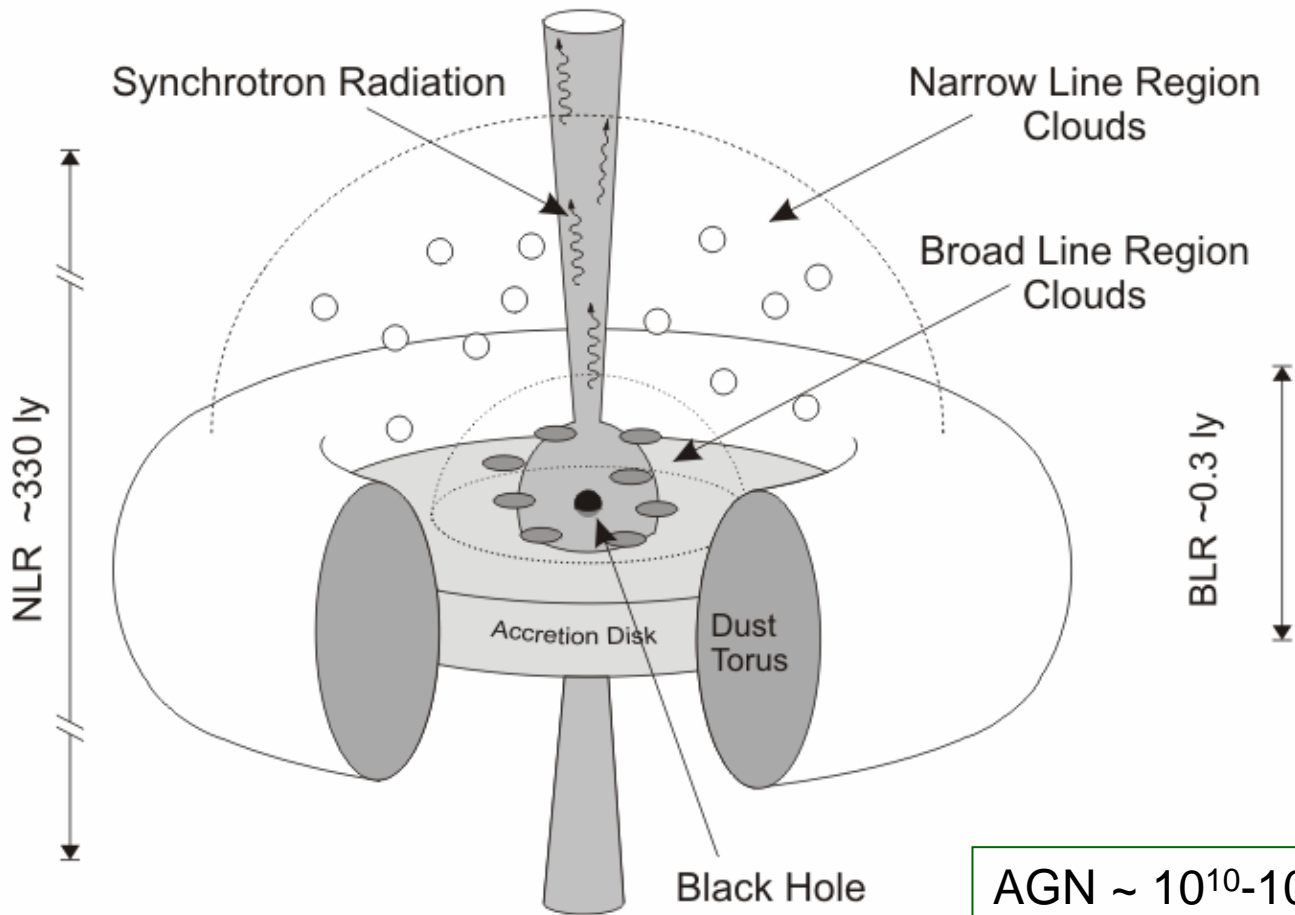


The first image is a [Hubble Heritage](#) image of M87, while the second one is a schematic diagram of an **AGN**

AGN-Verteilung



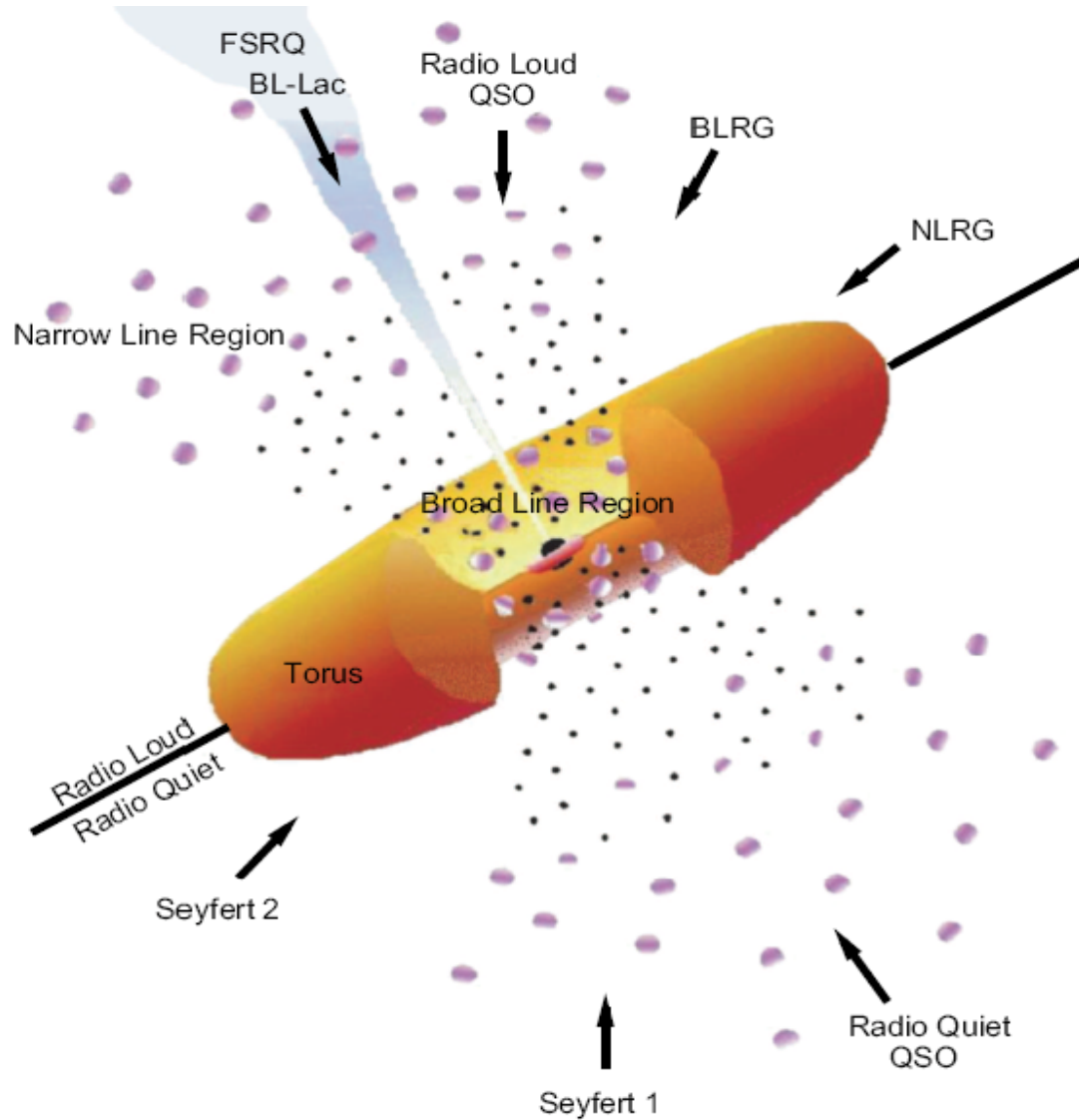
AGN Paradigm



AGN $\sim 10^{10}$ - 10^{13} times Solar luminosity

black hole ($\sim 10^6 - 10^9$ Solar masses)

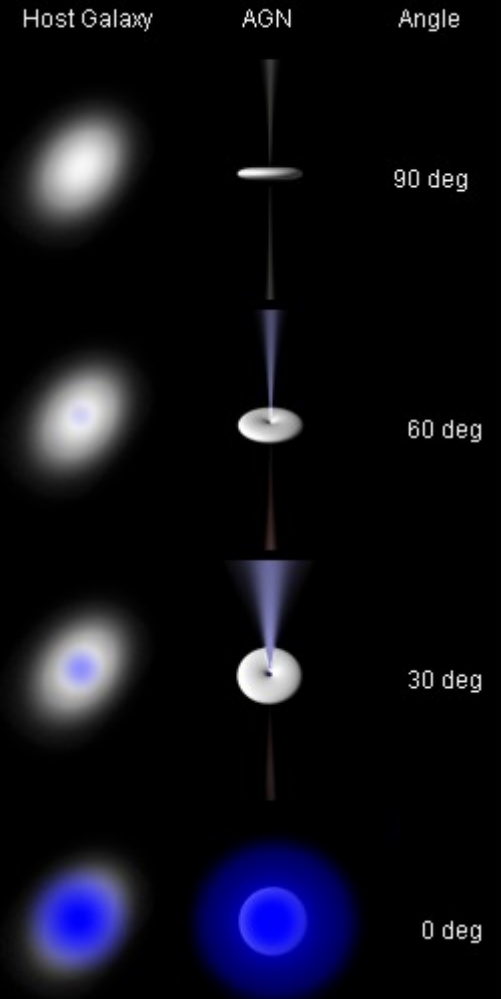
AGN-Phänomenologie



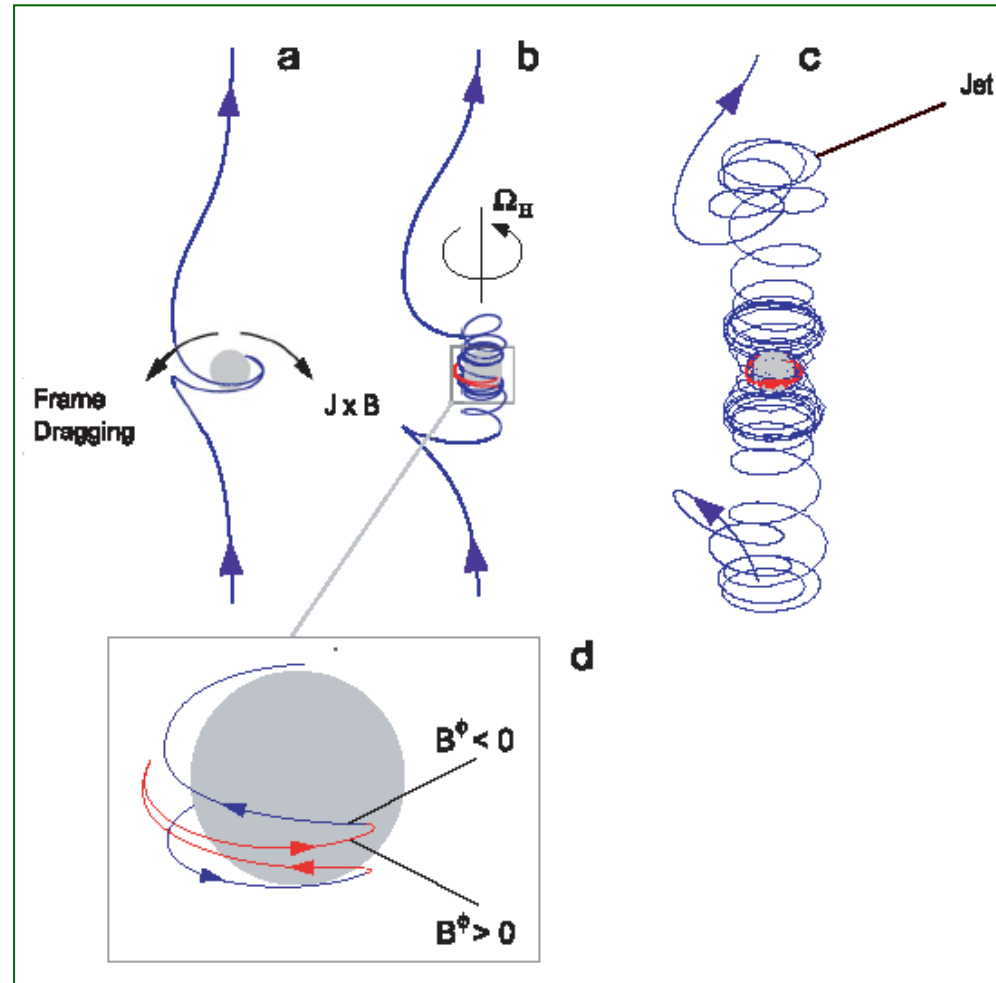
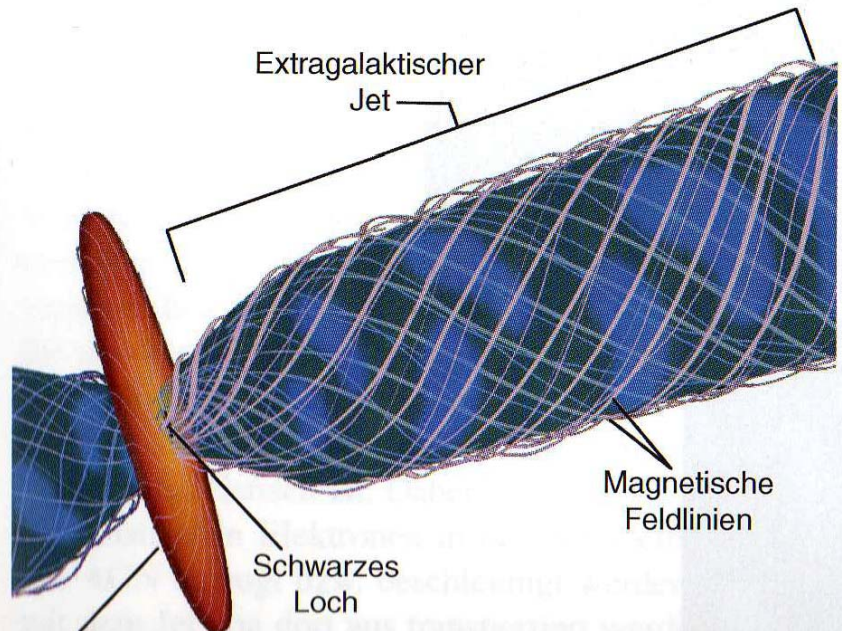
Jet-Richtung



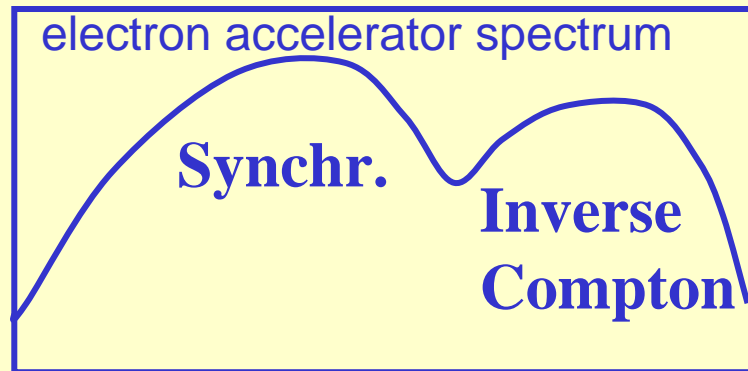
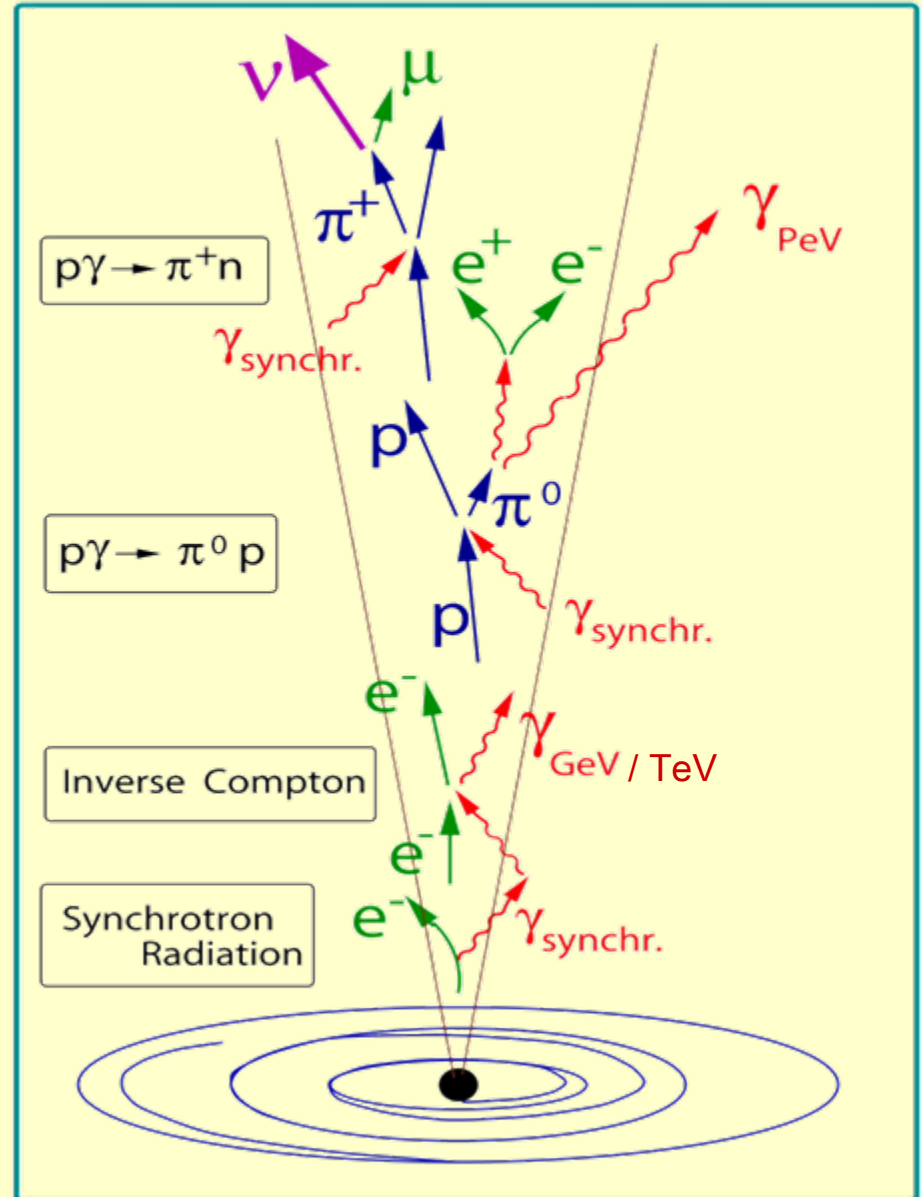
Observed Properties of Jets and the Angle to the Line of Sight θ



Ideen zur Jet-Ausbildung

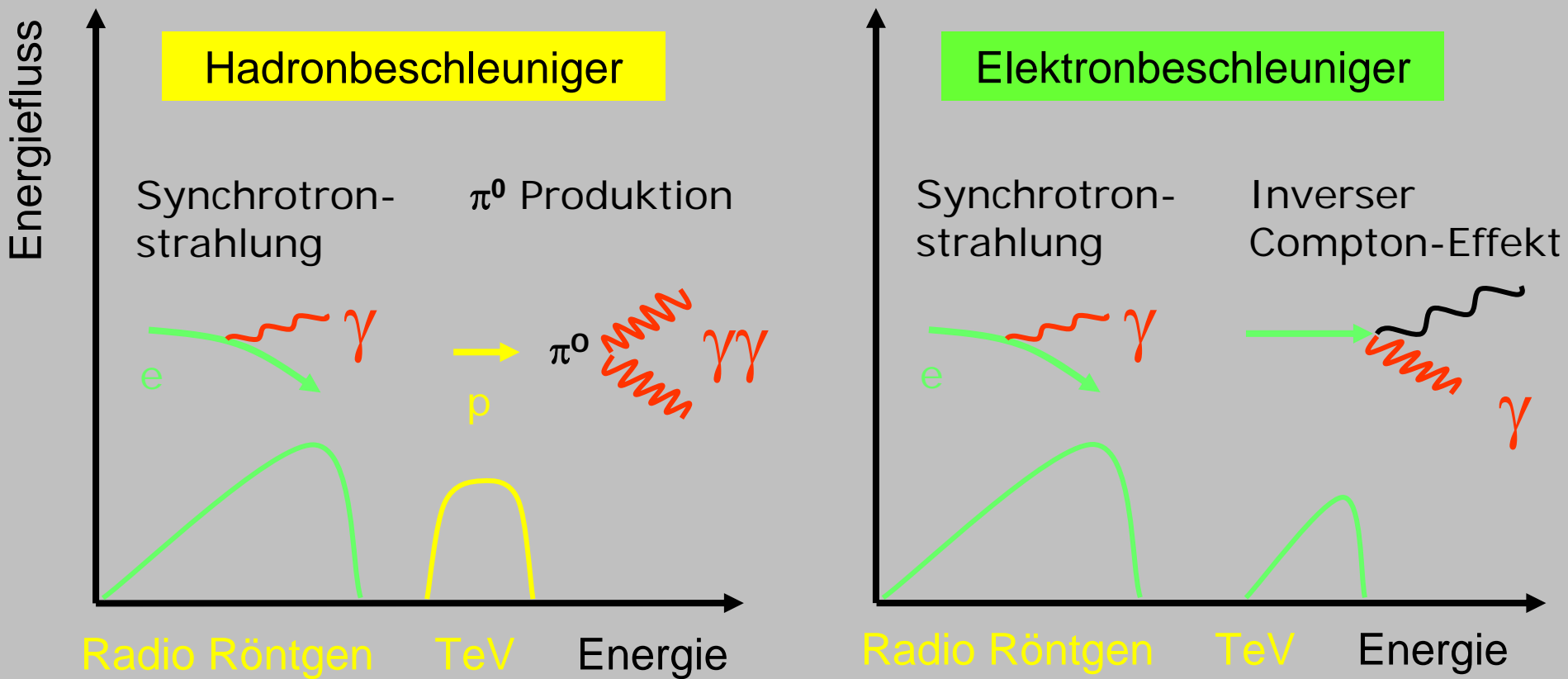


hadron or electron accelerators?

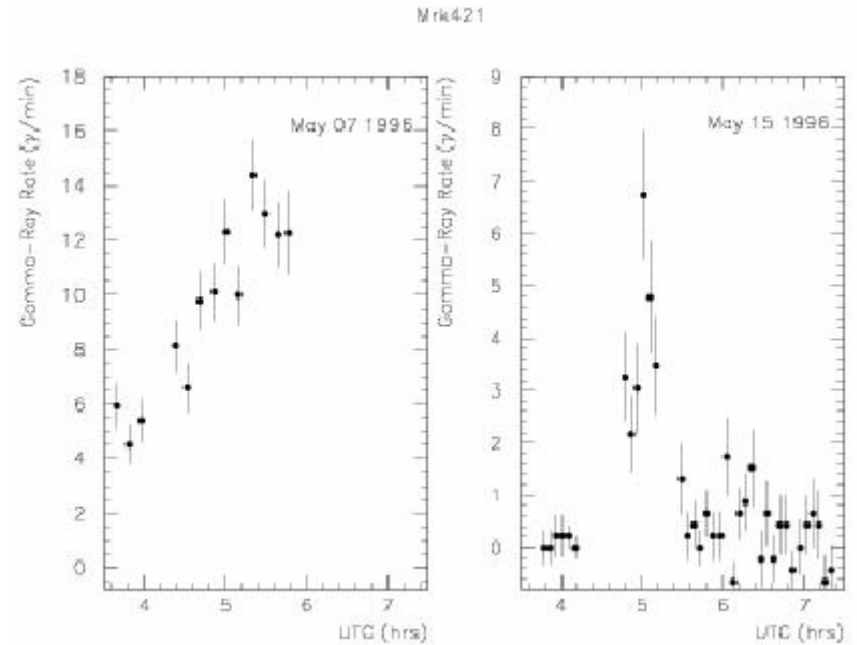
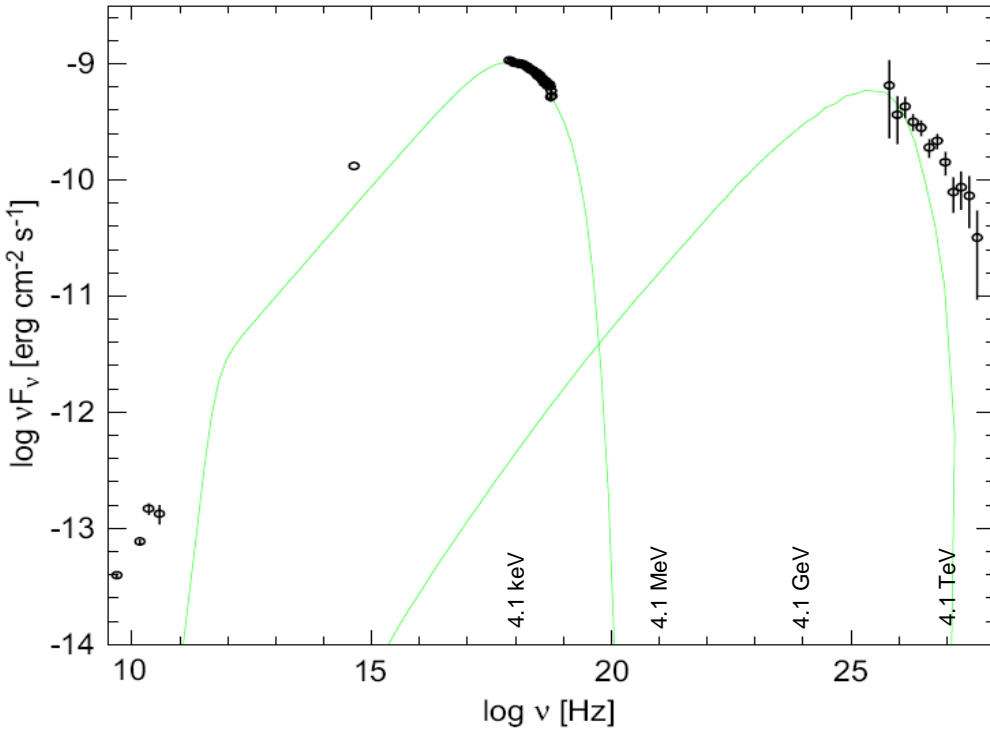


Radio optical X-ray GeV TeV
IR UV MeV

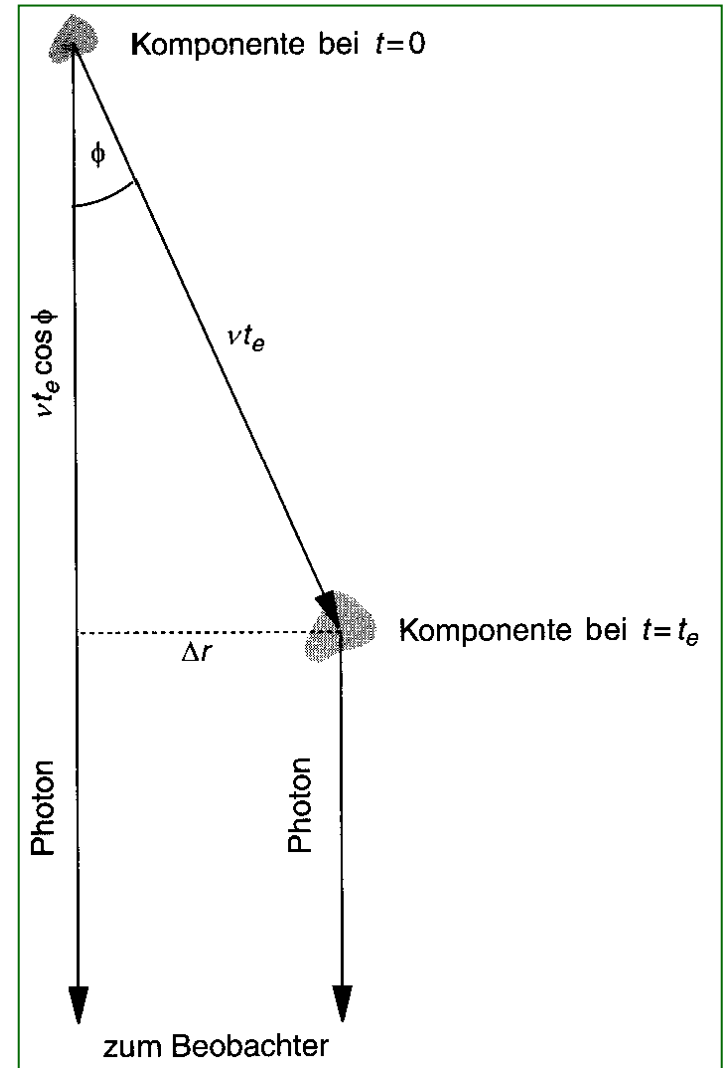
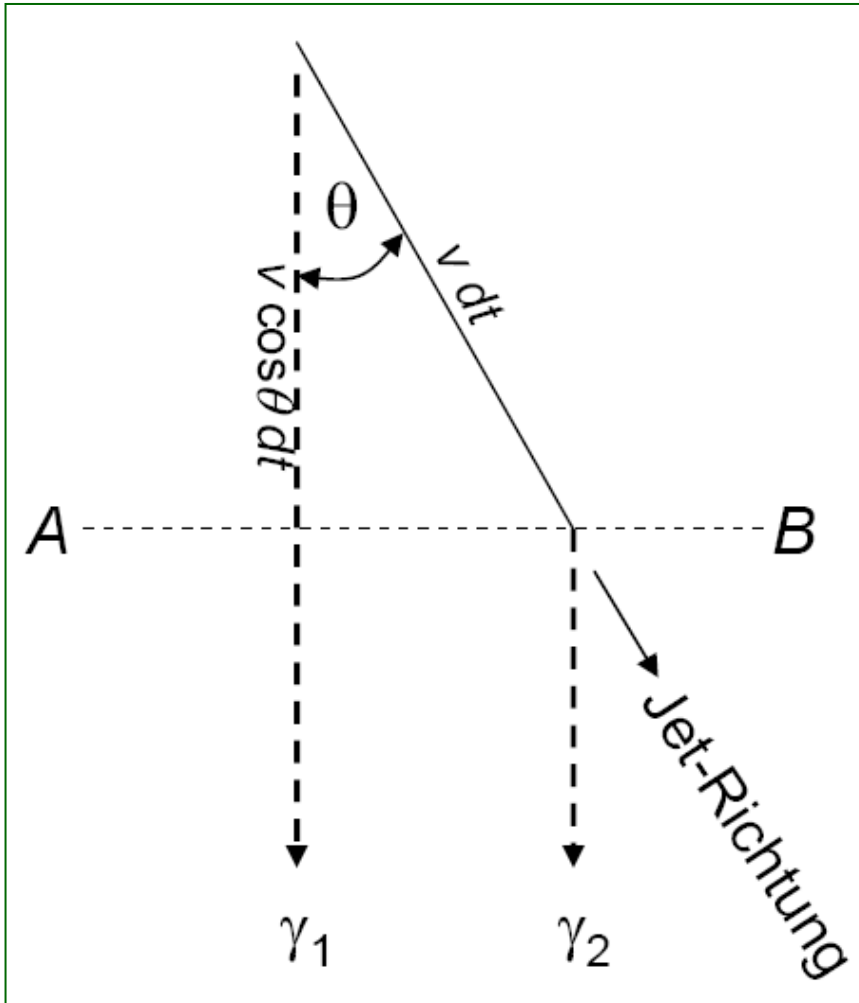
Gamma-Erzeugung



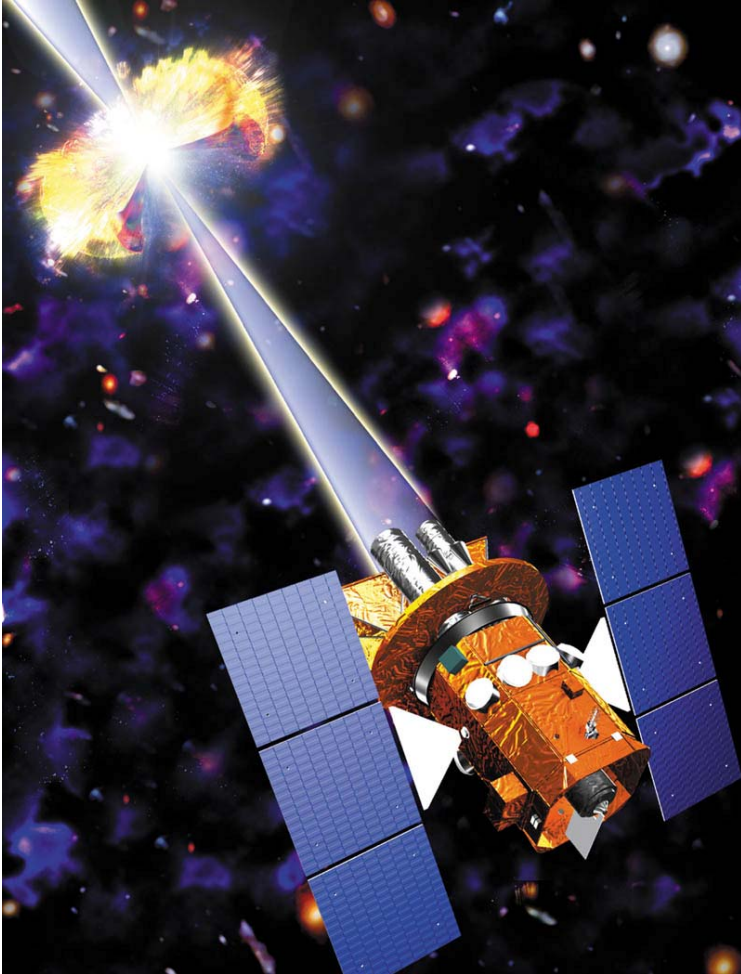
Blazar: Makarian 421



„Beaming“ und „Superluminal“



Gamma – Strahlungsausbrüche



Swift Satellite

