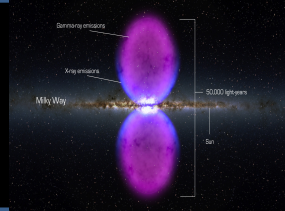


Source(s) Transitoire(s) de Neutrinos

Bruny Baret
Astroparticule & Cosmologie, Paris



Spectre neutrino astrophysiques



Galactique

Extra galactique

Source astrophysique

Soleil Supernova (exp. acc.) Binaires AGN/GRB UHECR diff

Energie

0.1-10 MeV

GeV

Tev-PeV

>PeV

Processus de production

desint. beta

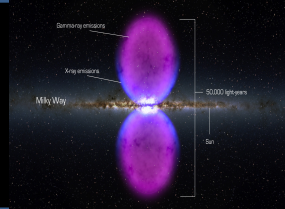
capture elec.

Interactions hadroniques

(top-down ?)



Spectre neutrino astrophysiques



Galactique

Extra galactique

Source astrophysique

Soleil

Supernova (exp.

acc.)

Binaires

AGN/GRB

UHECR diff

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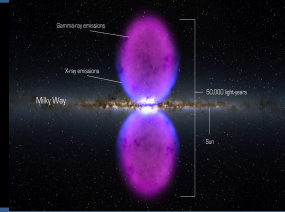
Interactions hadroniques

(top-down ?)

Transitoires



Spectre neutrino astrophysiques



Galactique

Extra galactique

Source astrophysique

Soleil	Supernova (exp.	acc.)	Binaires	AGN/GRB	UHECR diff
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Energie
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capture elec.

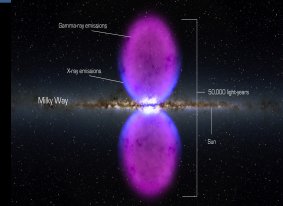
Interactions hadroniques

(top-down ?)

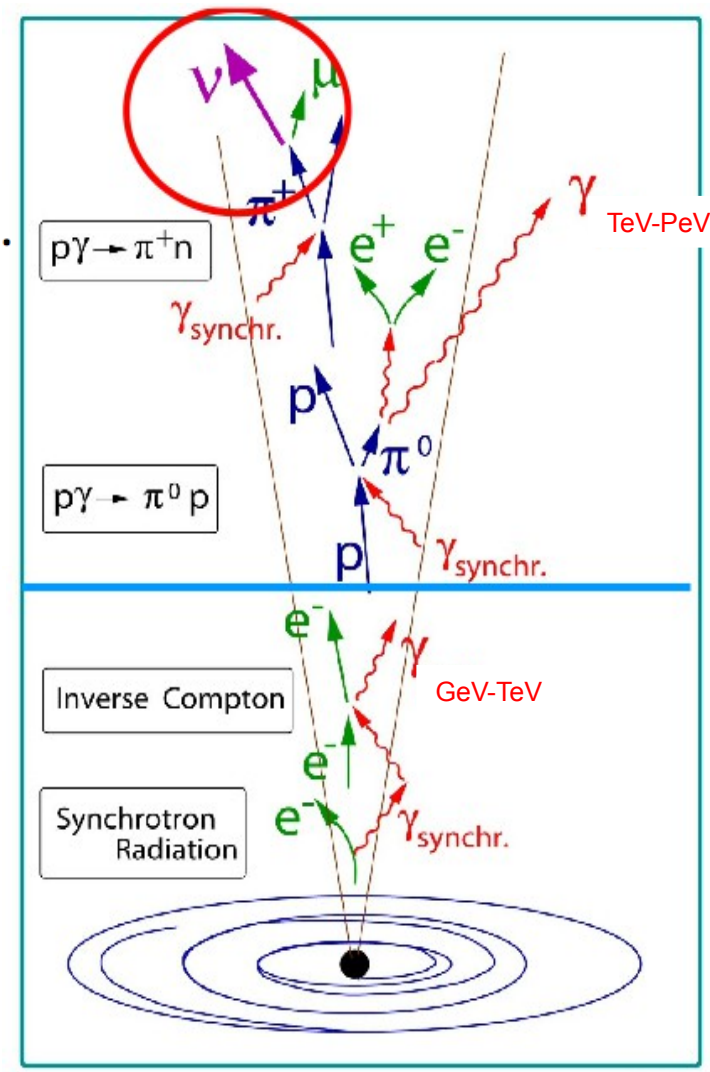
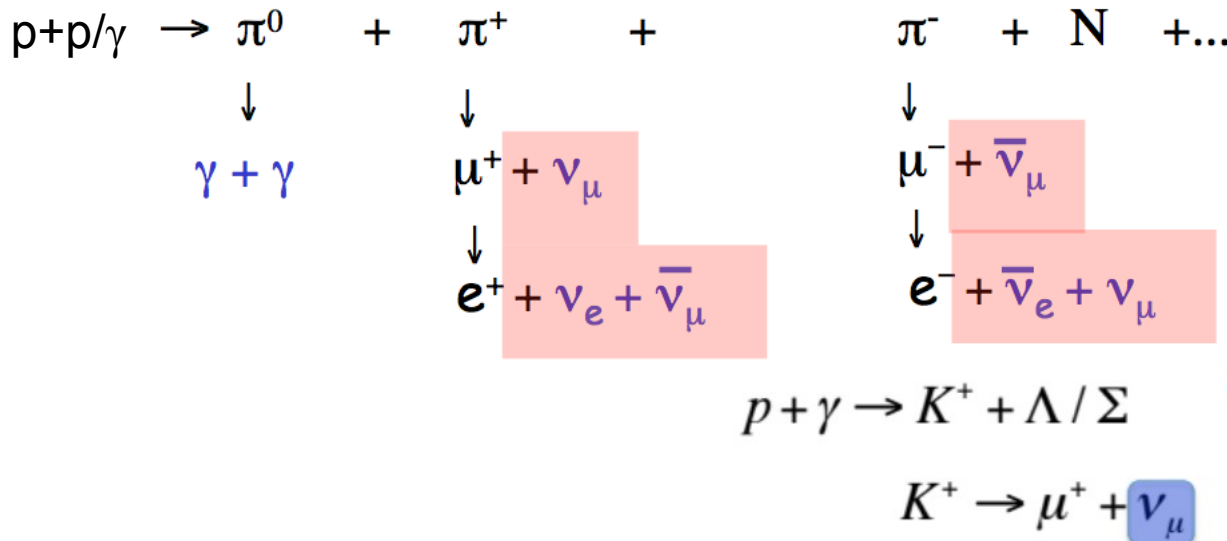
Accélération de CR
Transitoires



Jets : Lepto /hadro



Hadronic interaction in relativistic jets:



C.Spiessing

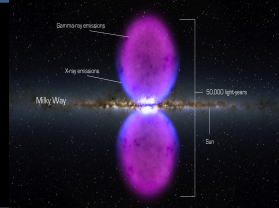
Production de H.E.:
 Hadronique → neutrinos
 leptonique (S.I.C.) → neutrinos

$$E_\nu \simeq 0.05 E_p$$

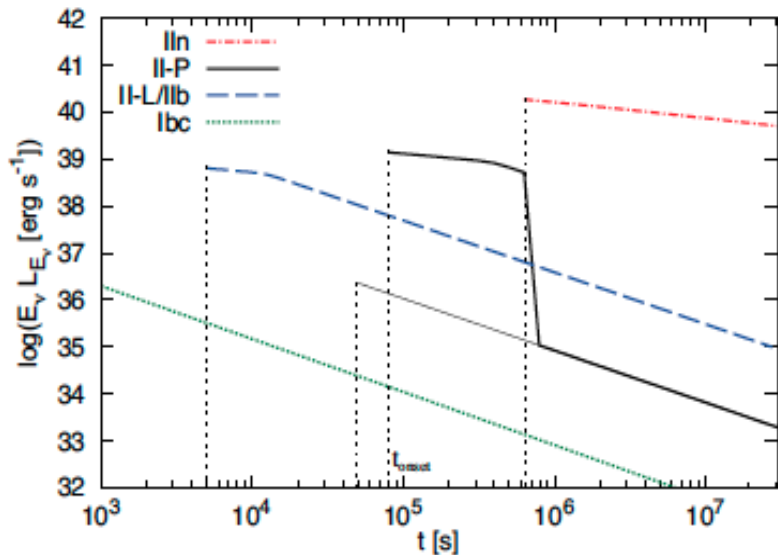
Oscillations → équiartition de saveurs



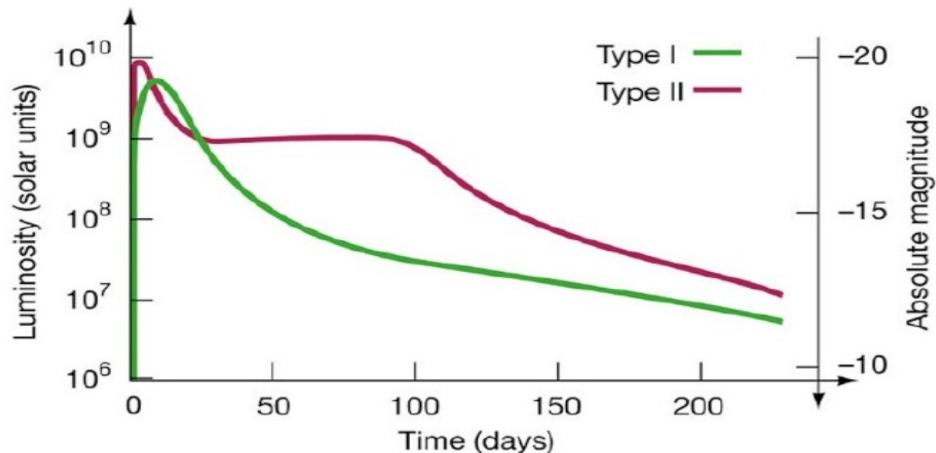
Supernovae – Hautes énergies



Murase 2017 : SN à 10kpc, interaction pp (CR+ CSM)

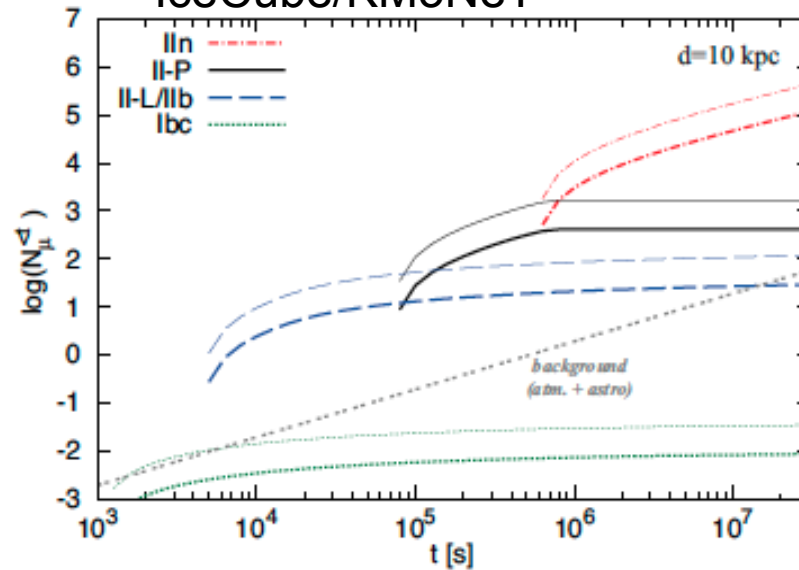


Type-I vs. Type-II Supernovae



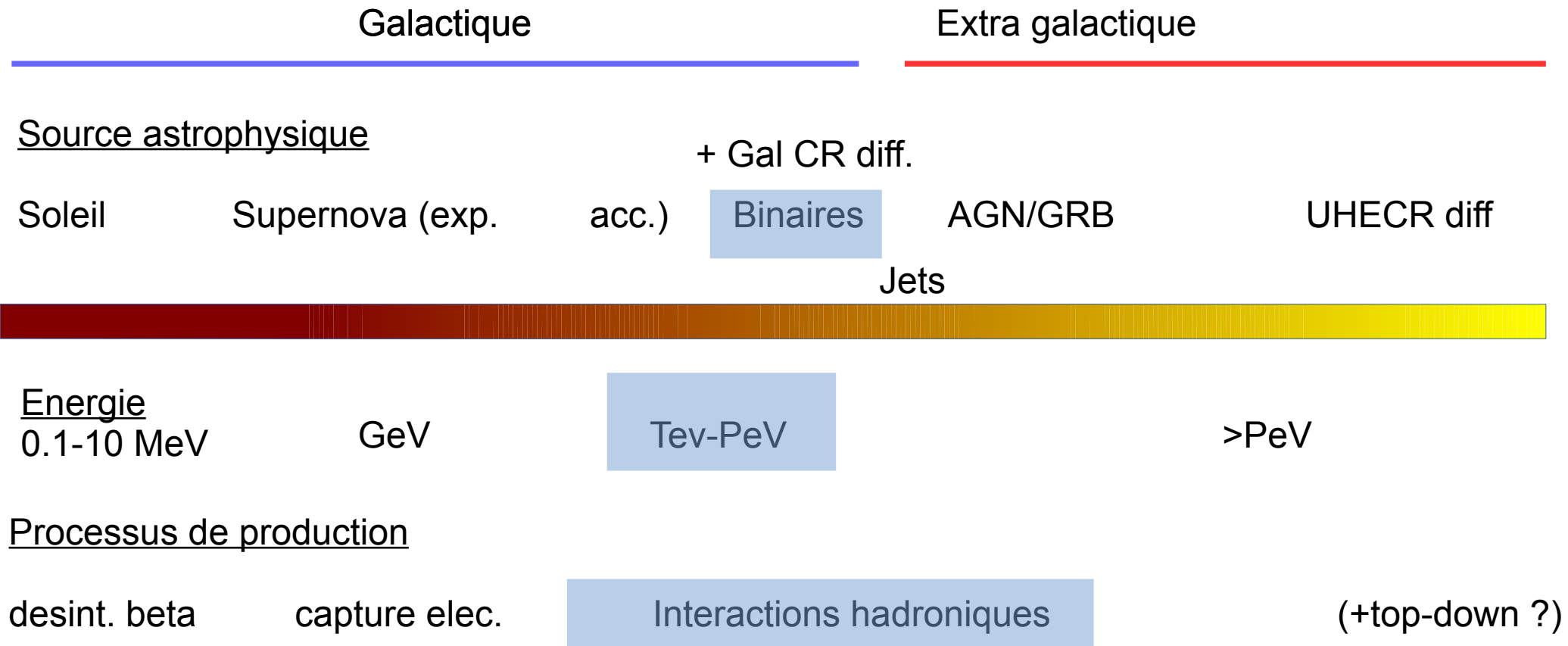
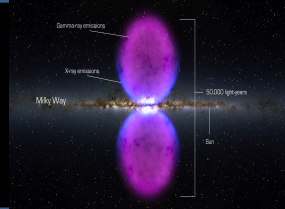
Copyright © 2005 Pearson Prentice Hall, Inc.

evt pour :
IceCube/KM3NeT



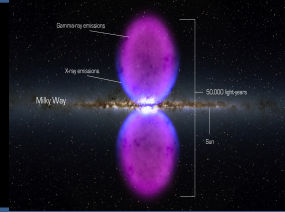


Spectre neutrino astrophysiques





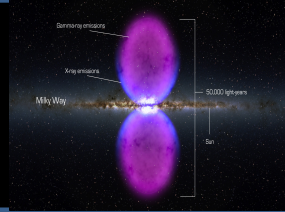
Informations accessibles



- Lancement du jet (facteur de Lorentz)
- Composition du jet i.e. charge baryonique
- Caractérisation des différentes phases d'accrétion/éjection



Sources potentielles du Flux Ice3

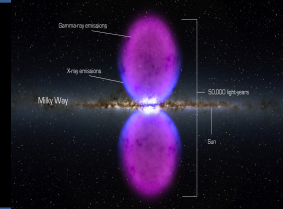


- **Galactic:** (full or partial contribution)
 - diffuse Galactic γ -ray emission [MA & Murase'13; Joshi J C, Winter W and Gupta'13
[Kachelriess and Ostapchenko'14; Neronov, Semikoz & Tchernin'13
[Neronov & Semikoz'14; Guo, Hu & Tian'14; Gaggero, Grasso, Marinelli, Urbano & Valli'15]
 - unidentified Galactic γ -ray emission [Fox, Kashiyama & Meszaros'13
[Gonzalez-Garcia, Halzen & Niro'14]
 - supernova remnants [Mandelartz & Tjus'14]
 - pulsars [Padovani & Resconi'14]
 - microquasars [Anchordoqui, Goldberg, Paul, da Silva & Vlcek'14]
 - Sagittarius A* [Bai, Barger, Barger, Lu, Peterson & Salvado'14; Fujita, Kimura & Murase'15]
 - *Fermi Bubbles* [MA & Murase'13; Razzaque'13
[Lunardini, Razzaque, Theodoseou & Yang'13; Lunardini, Razzaque & Yang'15]
 - Galactic Halo [Taylor, Gabici & Aharonian'14]
 - heavy dark matter decay [Feldstein, Kusenko, Matsumoto & Yanagida'13
[Esmaili & Serpico '13; Bai, Lu & Salvado'13; Cherry, Friedland & Shoemaker'14]

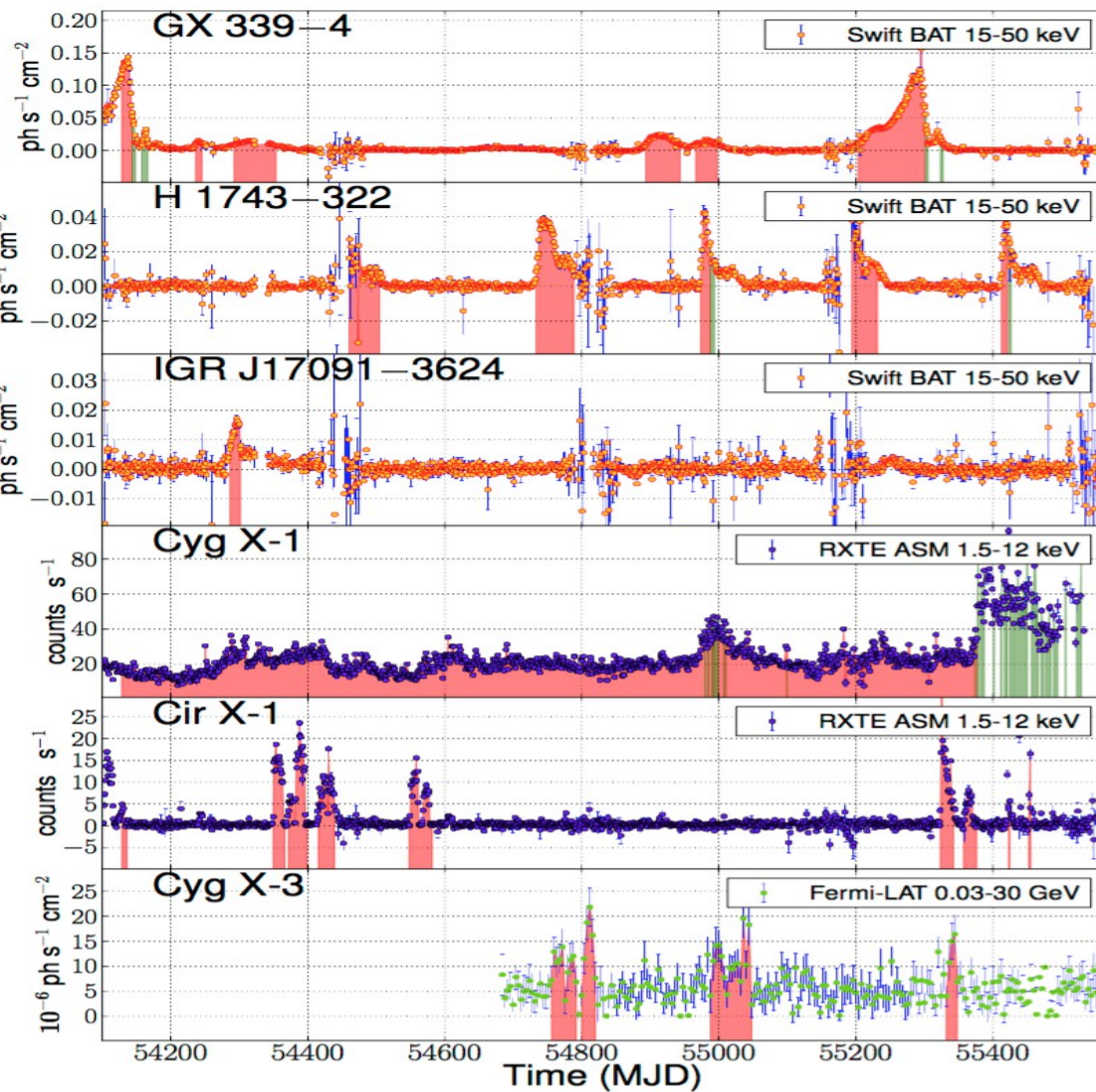
from M. Ahlers



Binaires/microquasars



ex : Cir X-1, GX 339-4, H1743-322, IGR J17091-3624, CygX-1 and CygX-3, HESS J0632+057



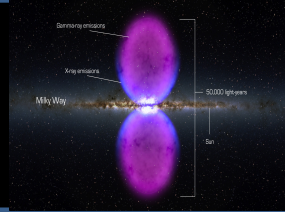
Cluster d'evt Antares et Ice3

- Accélération de p (pulsar, trou noir)
- Vent dense de matière
- Transitions high soft/ low hard
- Périodicité orbitale

Pas encore vu en neutrinos
mais
Certain modèles contraints



Sources potentielles - suite



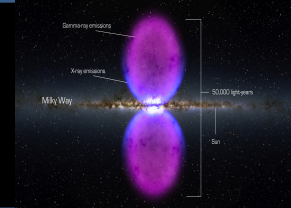
- **Extragalactic:**

- association with sources of UHE CRs [Kistler, Stanev & Yuksel'13]
[Katz, Waxman, Thompson & Loeb'13; Fang, Fujii, Linden & Olinto'14]
- association with diffuse γ -ray background [Murase, MA & Lacki'13]
[Chang & Wang'14; Ando, Tamborra & Zandanel'15]
- active galactic nuclei (AGN) [Stecker'13; Kalashev, Kusenko & Essey'13]
[Murase, Inoue & Dermer'14; Kimura, Murase & Toma'14; Kalashev, Semikoz & Tkachev'14]
[Padovani & Resconi'14; Petropoulou, Dimitrakoudis, Padovani, Mastichiadis & Resconi'15]
- gamma-ray bursts (GRB) [Murase & Ioka'13; Dado & Dar'14; Tamborra & Ando'15]
- galaxies with intense star-formation [He, Wang, Fan, Liu & Wei'13; Yoast-Hull, Gallagher, Zweibel & Everett'13]
[Murase, MA & Lacki'13; Anchordoqui, Paul, da Silva, Torres & Vlcek'14]
[Tamborra, Ando & Murase'14; Chang & Wang'14; Liu, Wang, Inoue, Crocker & Aharonian'14]
[Senno, Meszaros, Murase, Baerwald & Rees'15; Chakraborty & Izaguirre'15]
- galaxy clusters/groups [Murase, MA & Lacki'13; Zandanel, Tamborra, Gabici & Ando'14]
- ...

from M. Ahlers



Spectre neutrino astrophysiques



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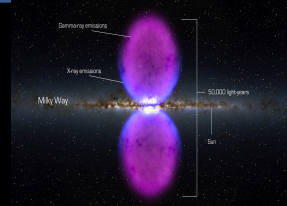
capture elec.

Interactions hadroniques

(+top-down ?)

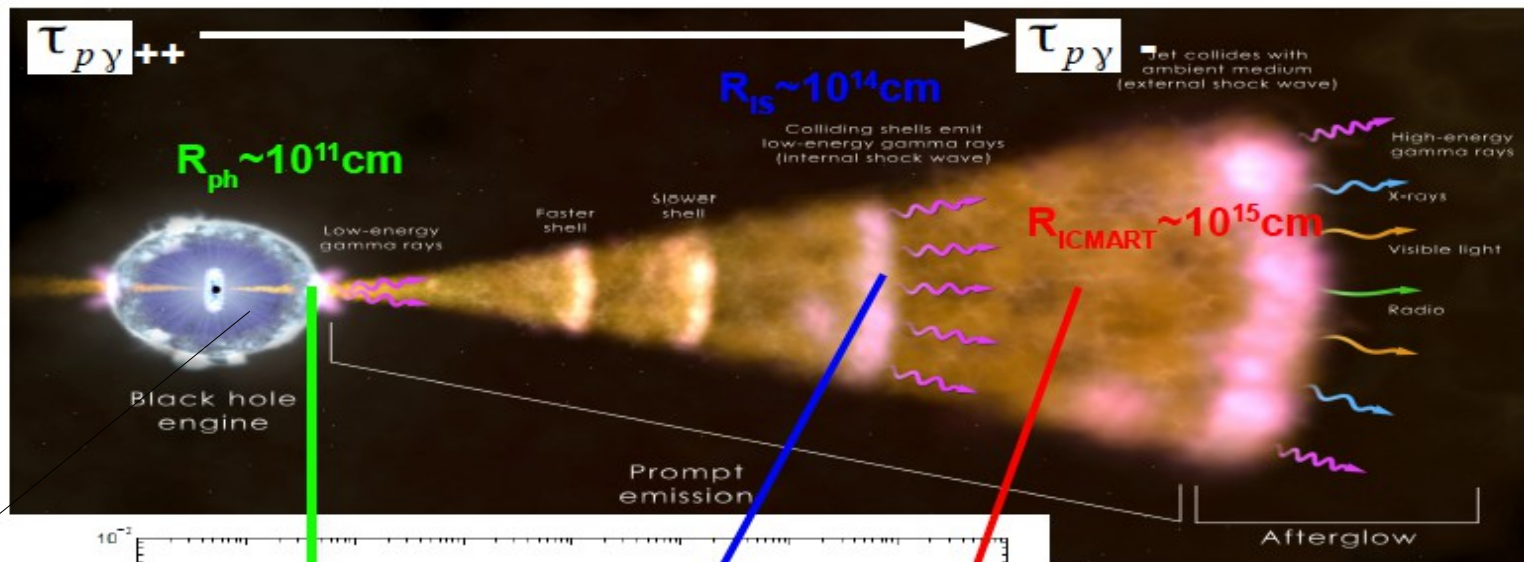


GRBs

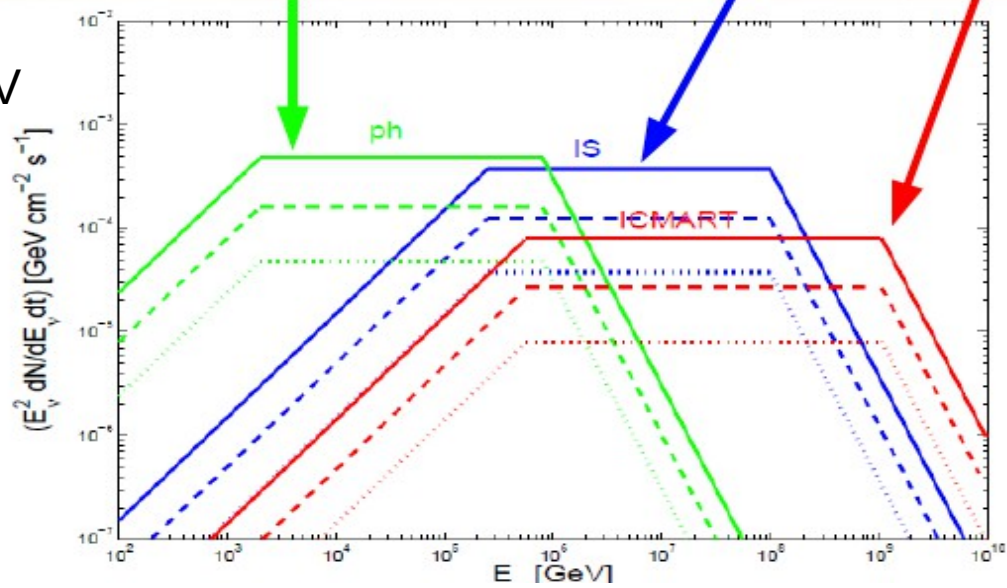


Gamma=O(100)

Contraindre la charge baryonique ?



pp->5-100GeV
échappement
des n

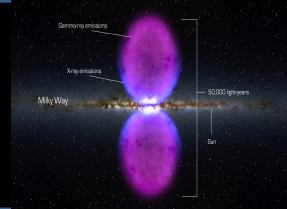


GW included

From Zhang&Kumar 2013

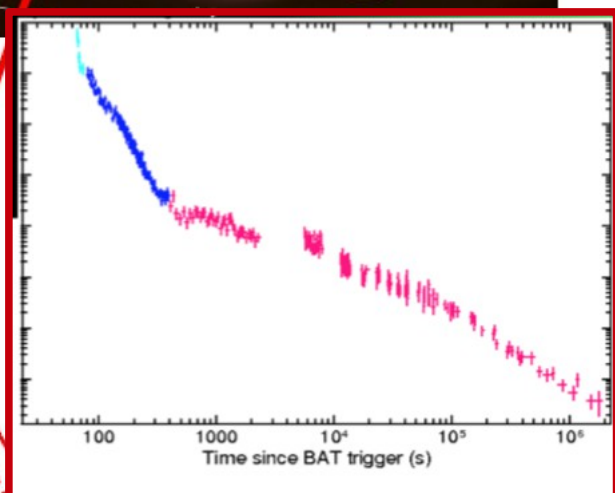
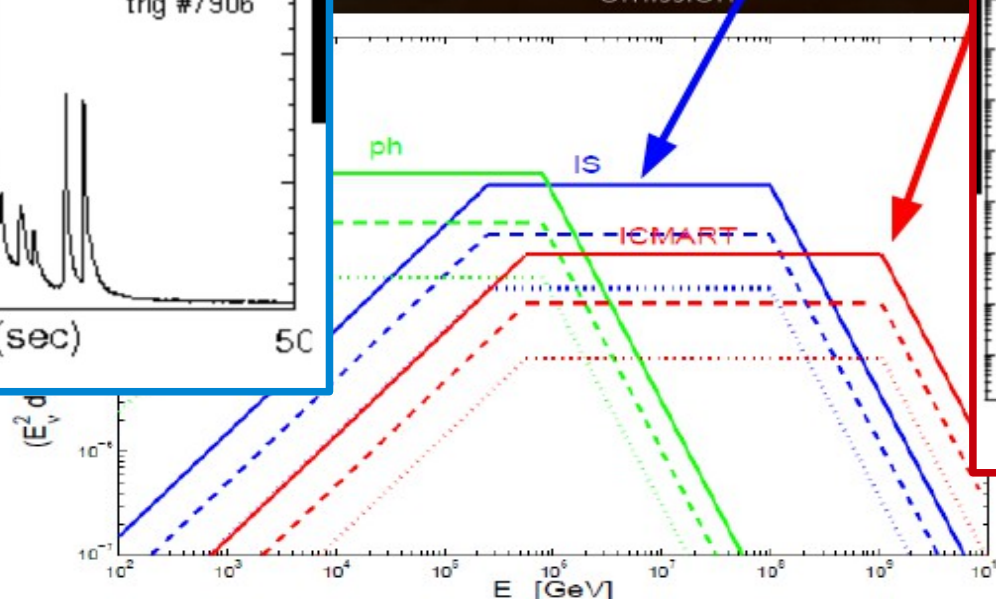
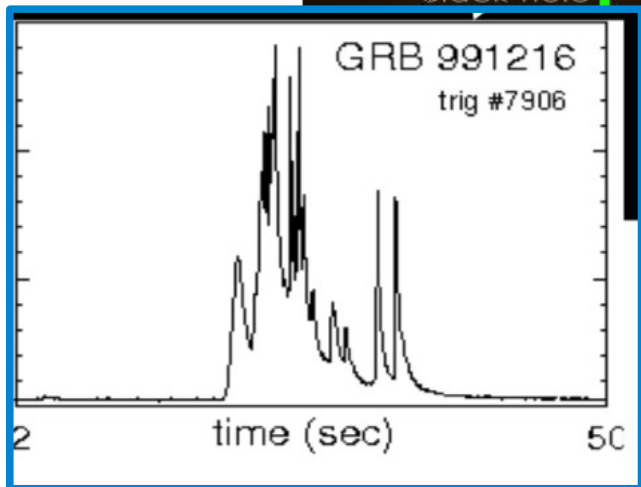
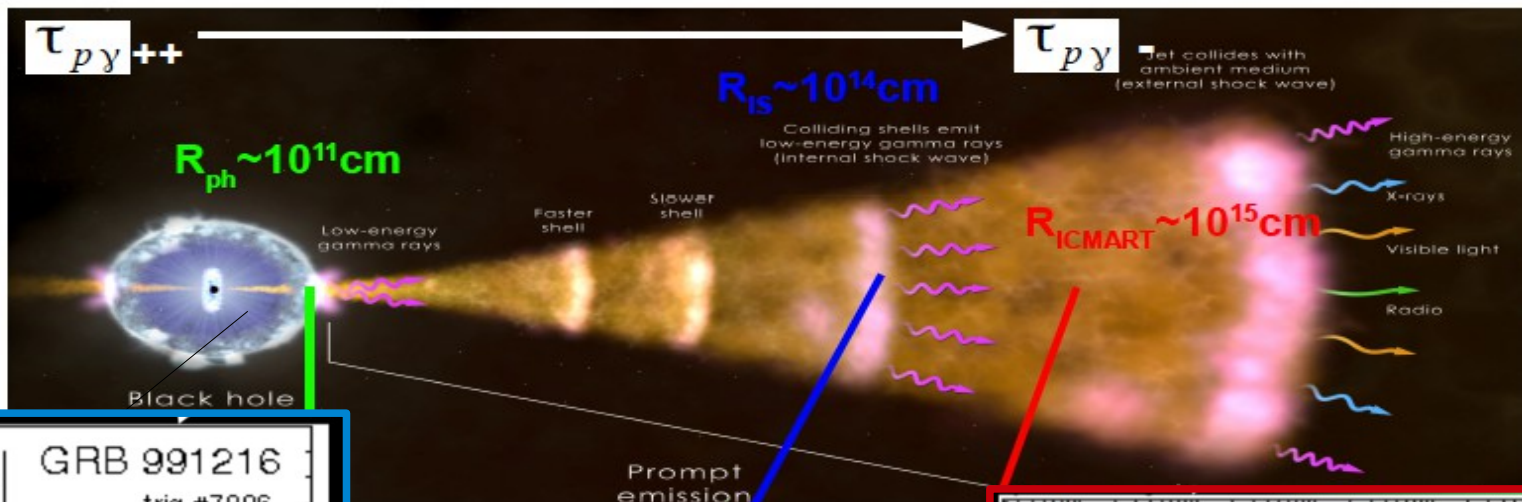


GRBs



Gamma=O(100)

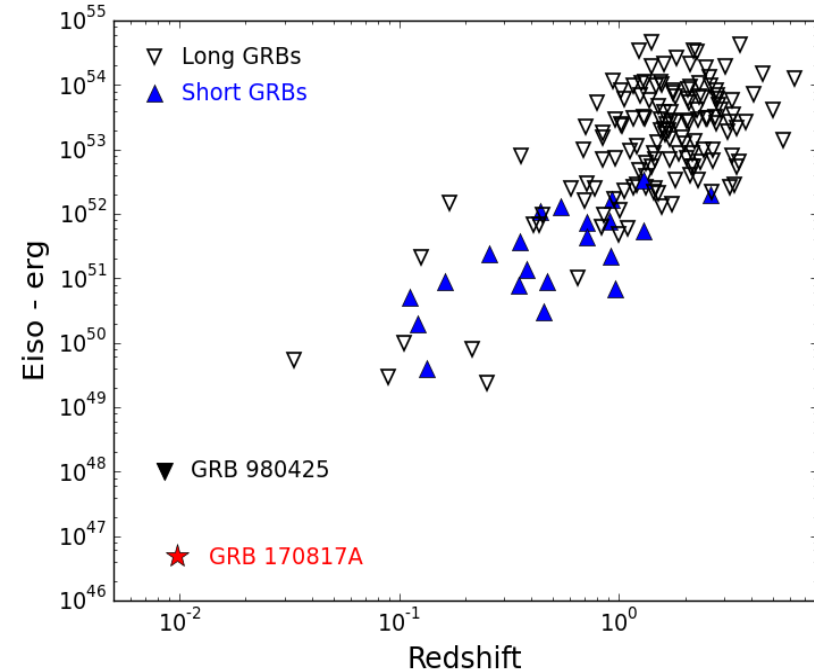
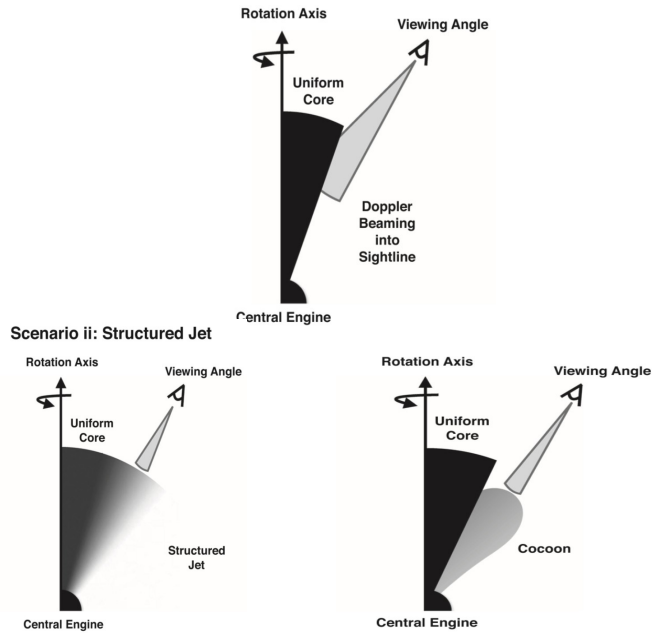
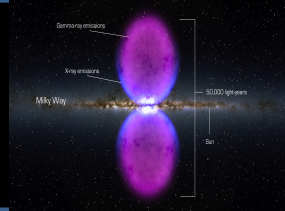
Contraindre la charge baryonique ?



From Zhang&Kumar 2013

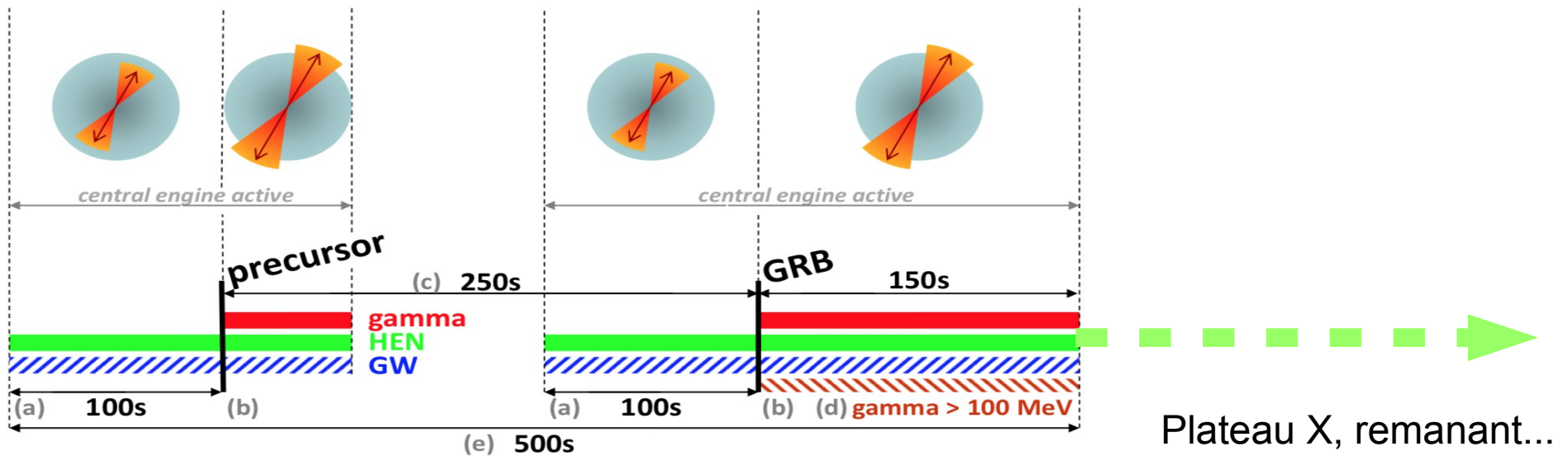
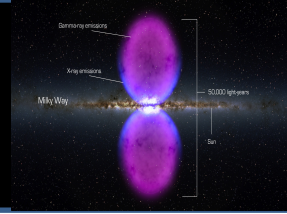


Puissance – distance – orientation/structure du jet





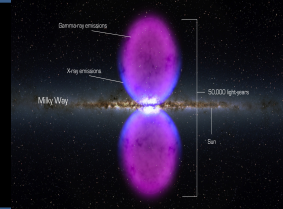
Délais par rapport au prompt



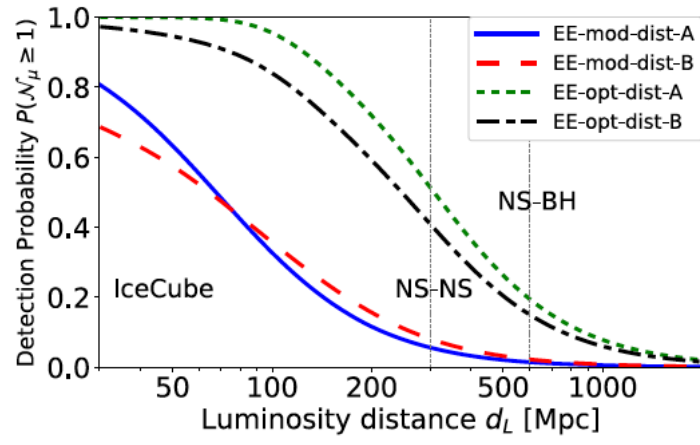
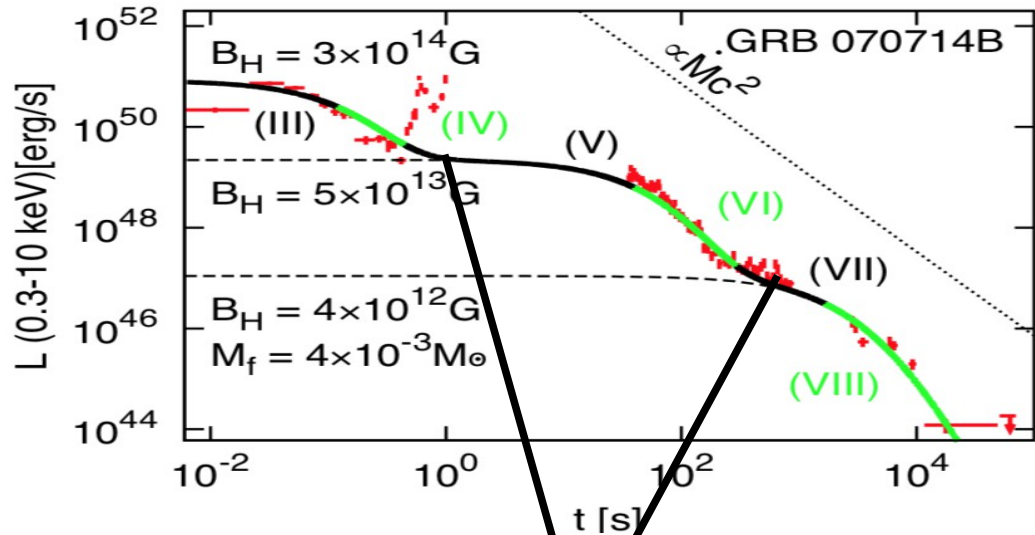
Baret et al. PRD 2011



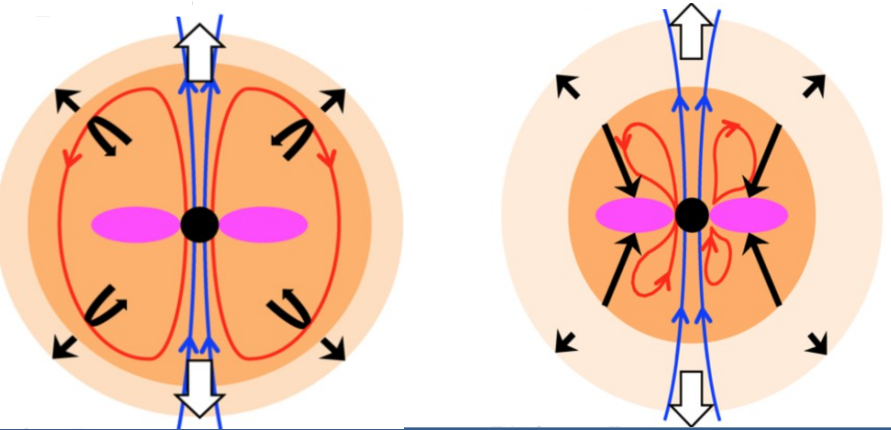
Au delà du prompt I



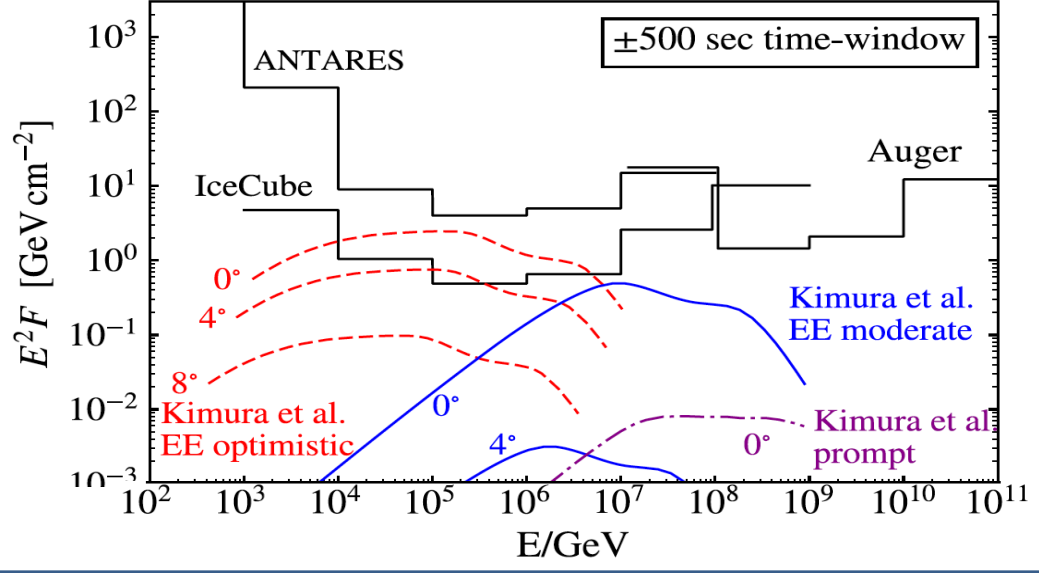
Kisaka & Ioka 2015



Extended Emission :
« accretion fallback »

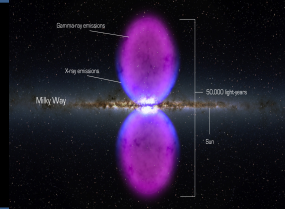


GW170817 Neutrino limits (fluence per flavor: $\nu_x + \bar{\nu}_x$)





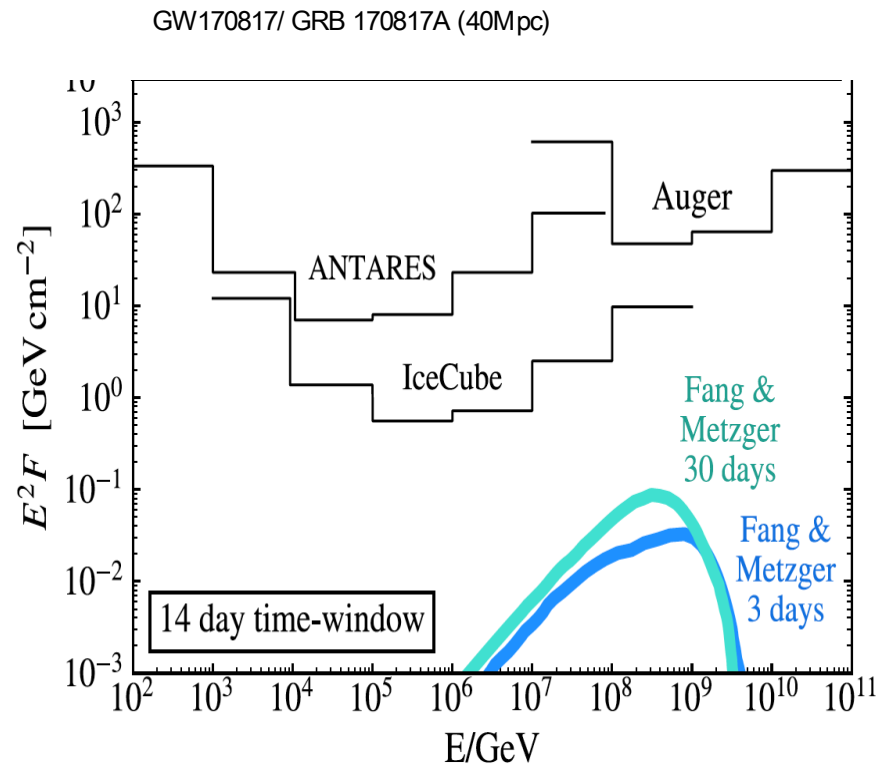
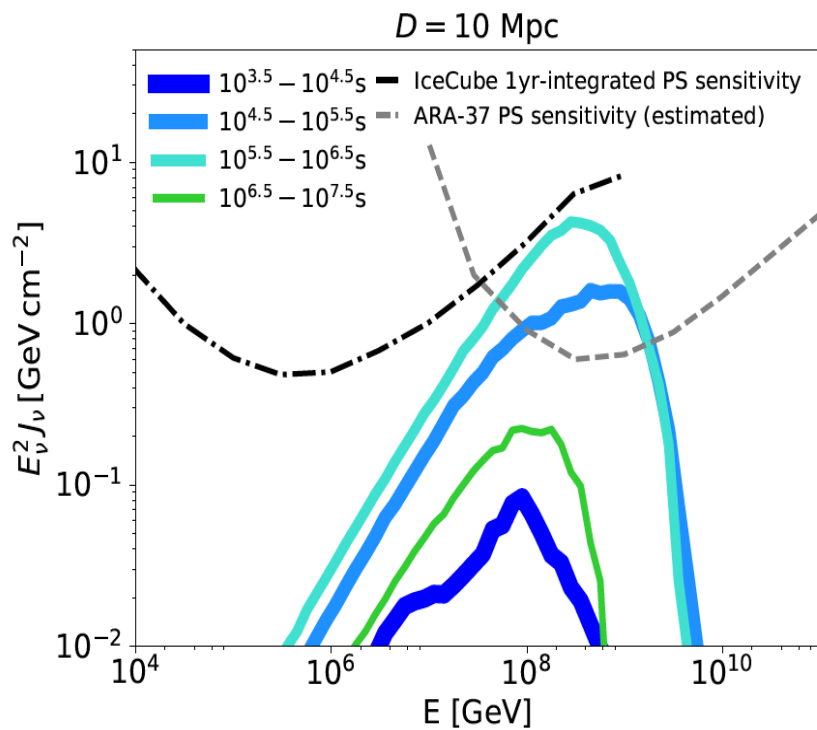
Au delà du prompt II



Fang and Metzger 2017 :
Pulsar ms + Ejecta + Rad.

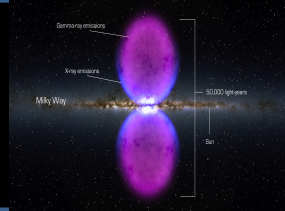
UHECR acc. & int.

HE neutrinos





Spectre neutrino astrophysiques



Galactique

Extra galactique

Source astrophysique

+ Gal CR diff.

Soleil	Supernova (exp. acc.)	Binaires	AGN/GRB	UHECR diff
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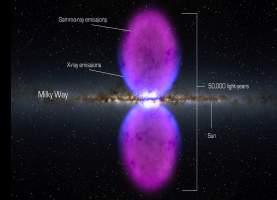
capture elec.

Interactions hadroniques

(+top-down ?)

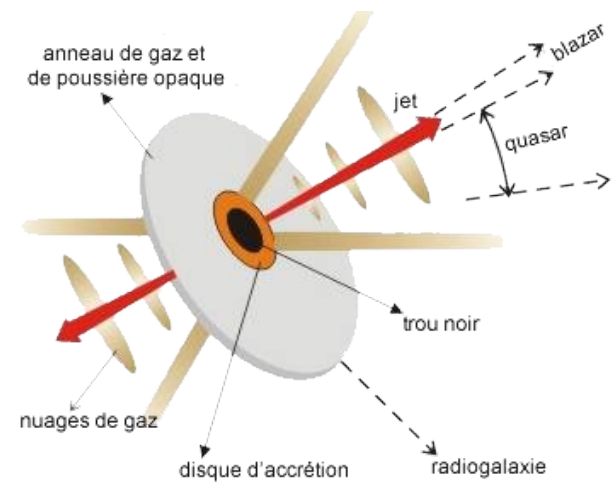
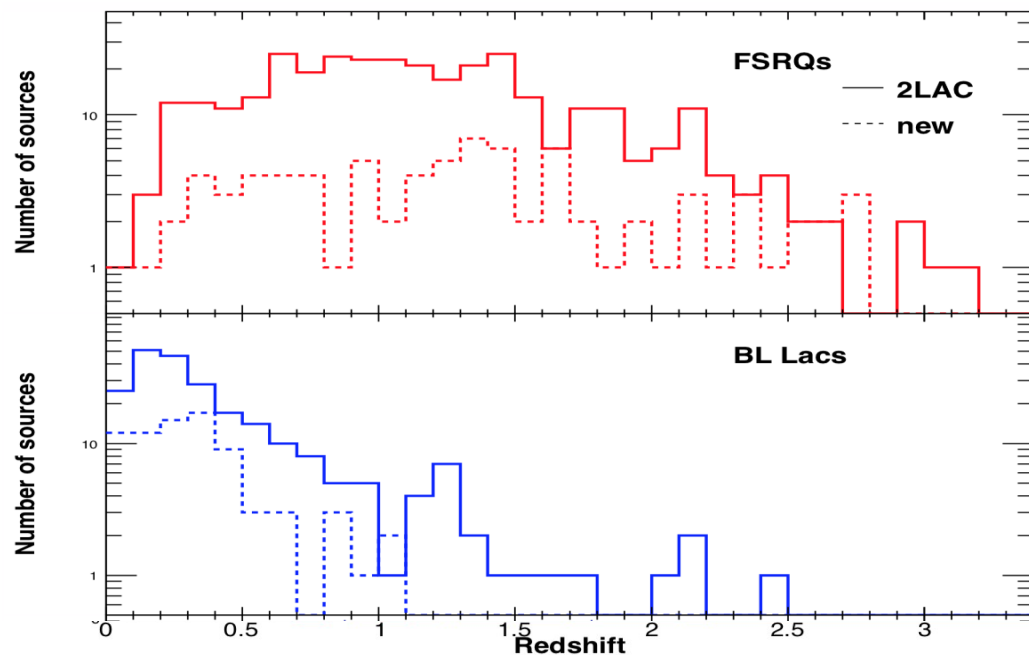
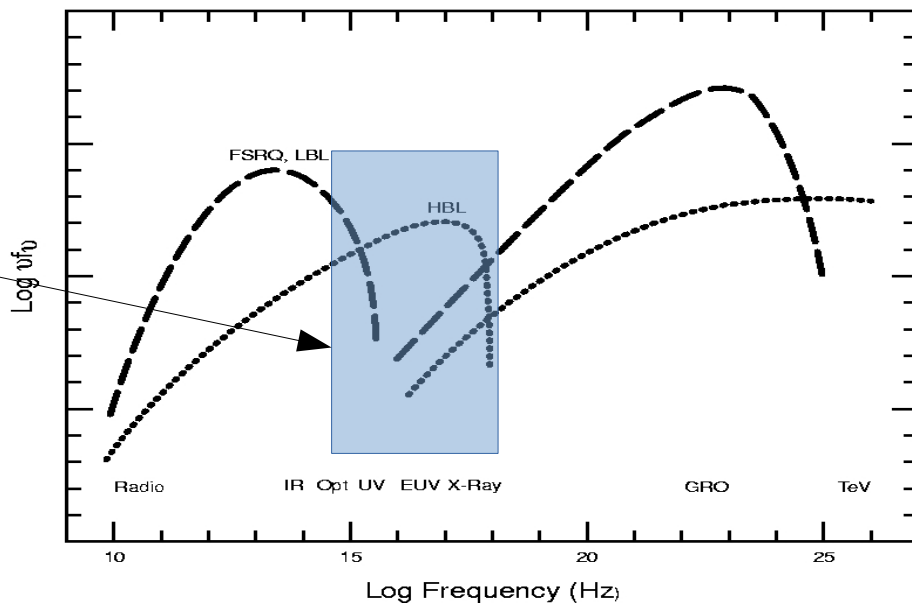


Blazars



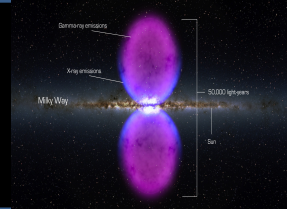
Photohadronique
 Photons cibles UV-X \rightarrow TeV-PeV Neutrinos

Collimation relativiste
 +
 Haute variabilité

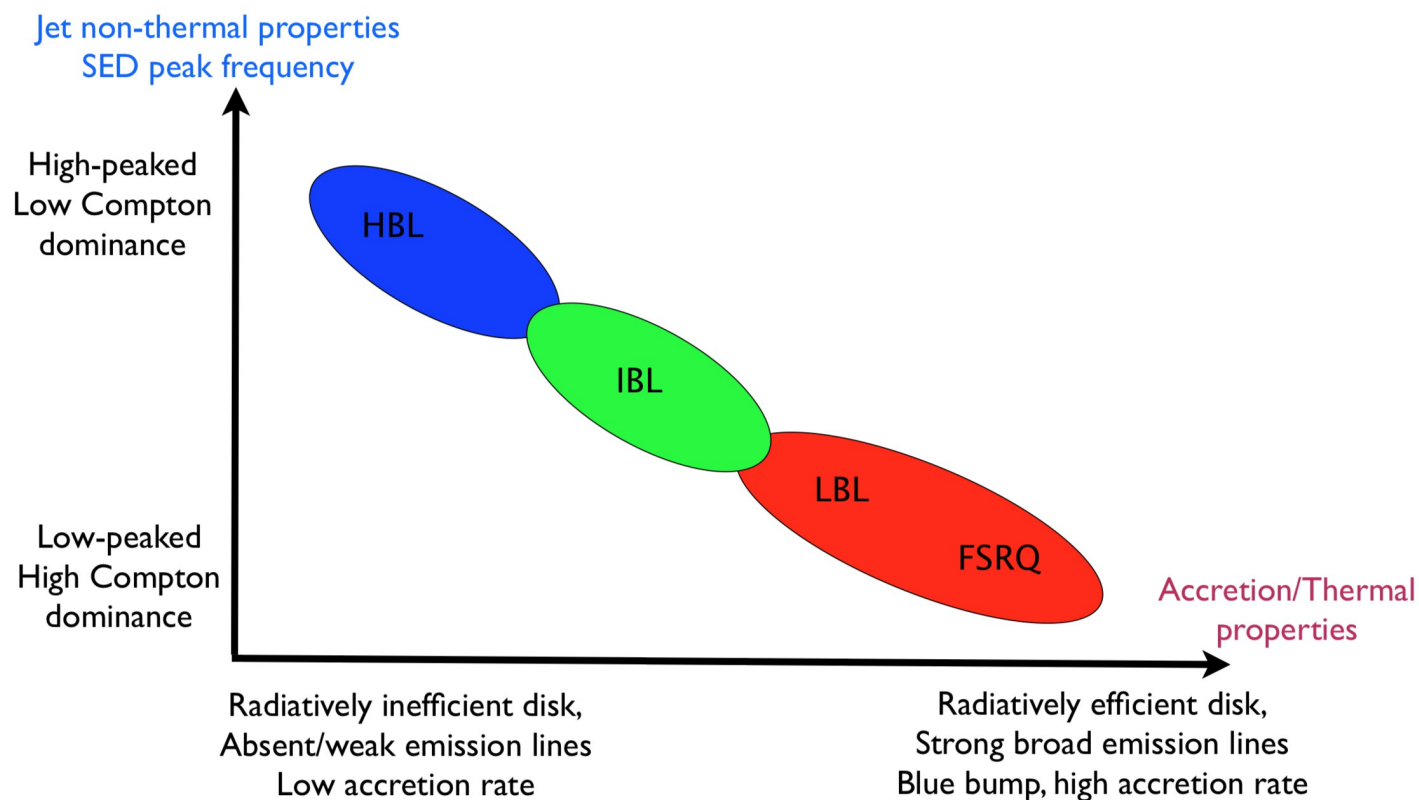
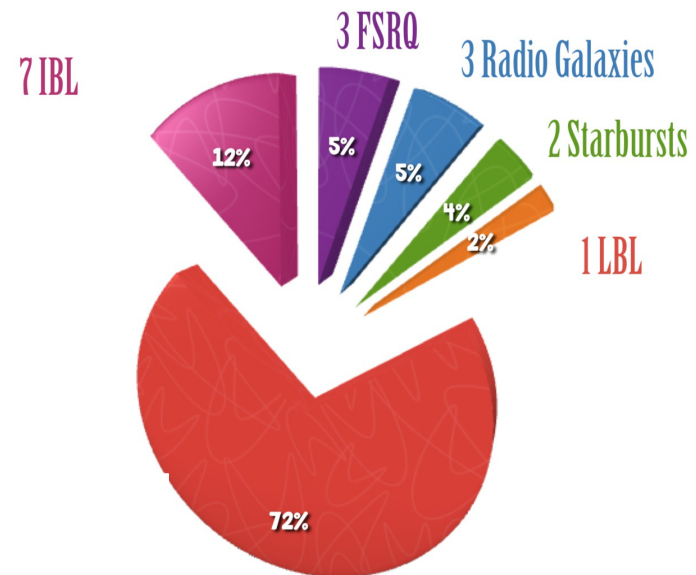




Quels blazars ?



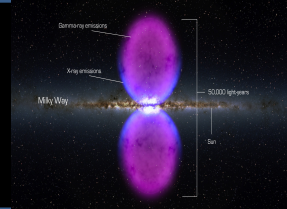
Blazars VHE gamma



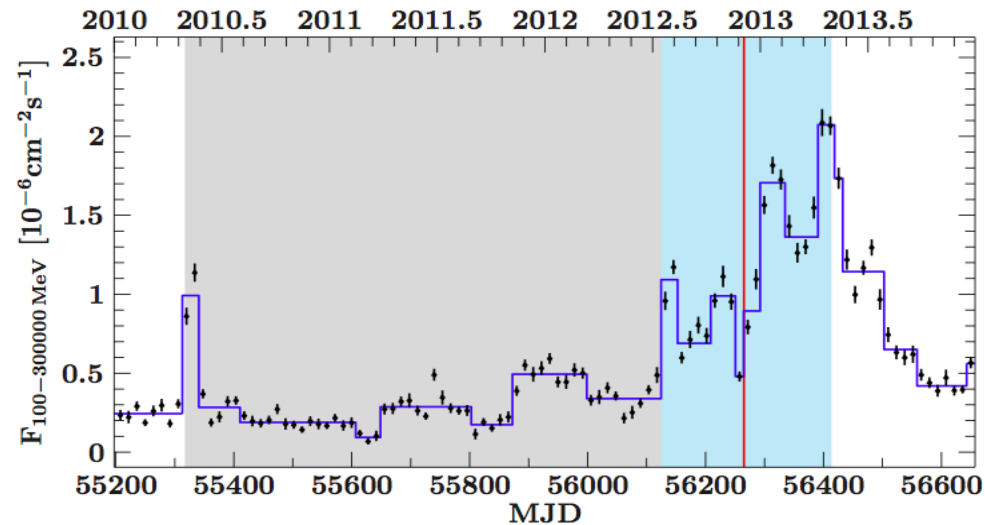
L. Costamante



Des indices ?



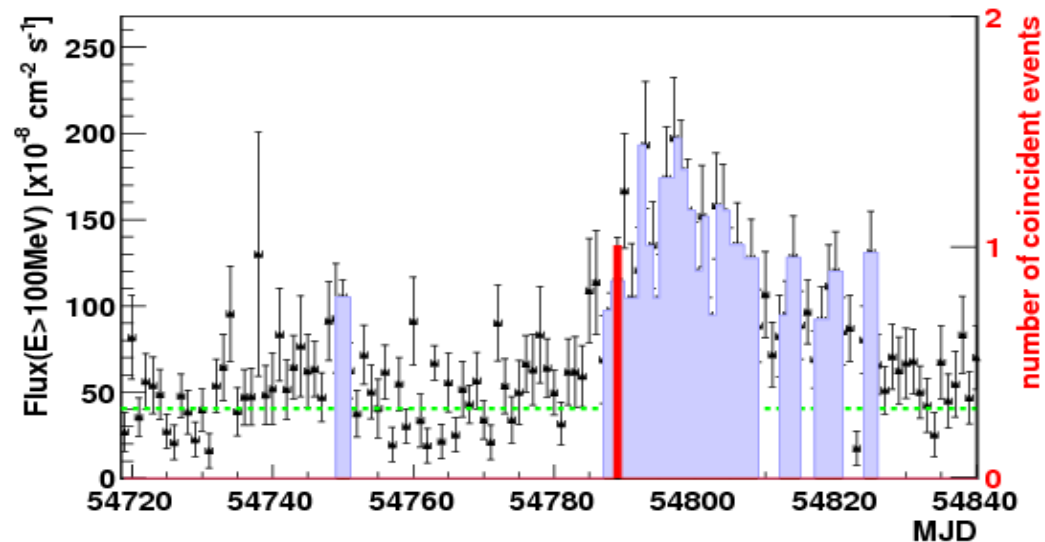
PKS B1424-418



IceCube

IceCube

3C279

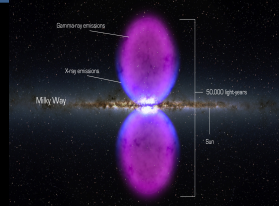


Antares

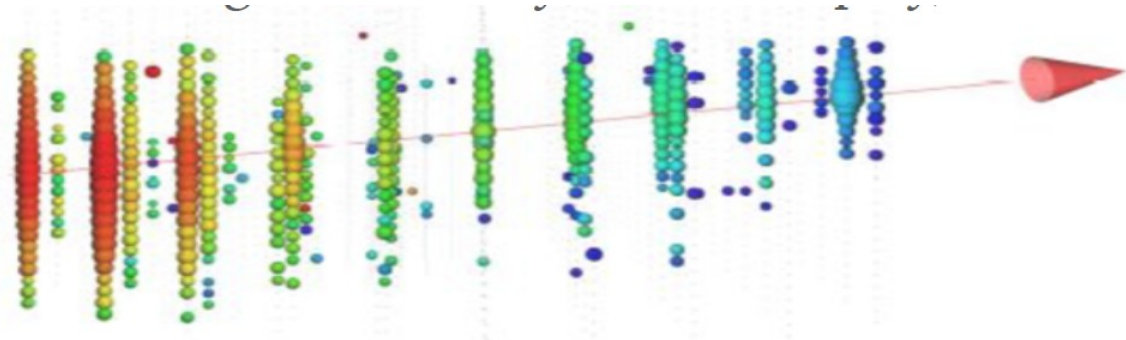
MAIS : on est allé chercher des neutrinos pendant des flares...



IC170922A : Alerte EHE ICE3 #5



- 22nd Sept. 2017 at 20:54:30 UTC
- First notice: 22nd Sept. 2017 at 20:55:13 (43s later)
- Deposited energy ~ 120 TeV
- Angular error: $\sim 15'$



Fermi-LAT detection of increased gamma-ray activity of TXS 0506+056, located inside the IceCube-170922A error region.

ATel #10791; *Yasuyuki T. Tanaka (Hiroshima University), Sara Buson (NASA/GSFC), Daniel Kocevski (NASA/MSFC) on behalf of the Fermi-LAT collaboration*
on 28 Sep 2017; 10:10 UT
Credential Certification: David J. Thompson (David.J.Thompson@nasa.gov)

- Significance of the coincidence:
rate of neutrinos \times *blazar density* \times *duty cycle* $\rightarrow \sim 4\sigma$

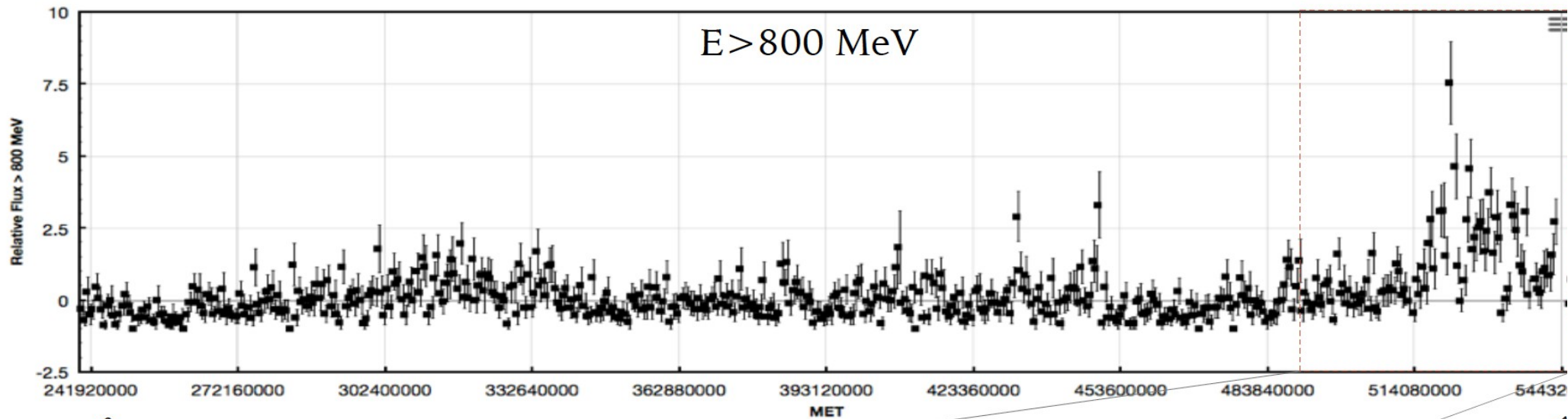
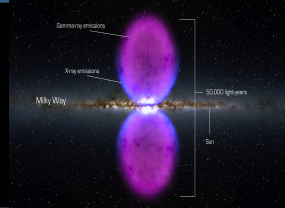
A. Coleiro

First-time detection of VHE gamma rays by MAGIC from a direction consistent with the recent EHE neutrino event IceCube-170922A

ATel #10817; *Razmik Mirzoyan for the MAGIC Collaboration*
on 4 Oct 2017; 17:17 UT
Credential Certification: Razmik Mirzoyan (Razmik.Mirzoyan@mpp.mpg.de)

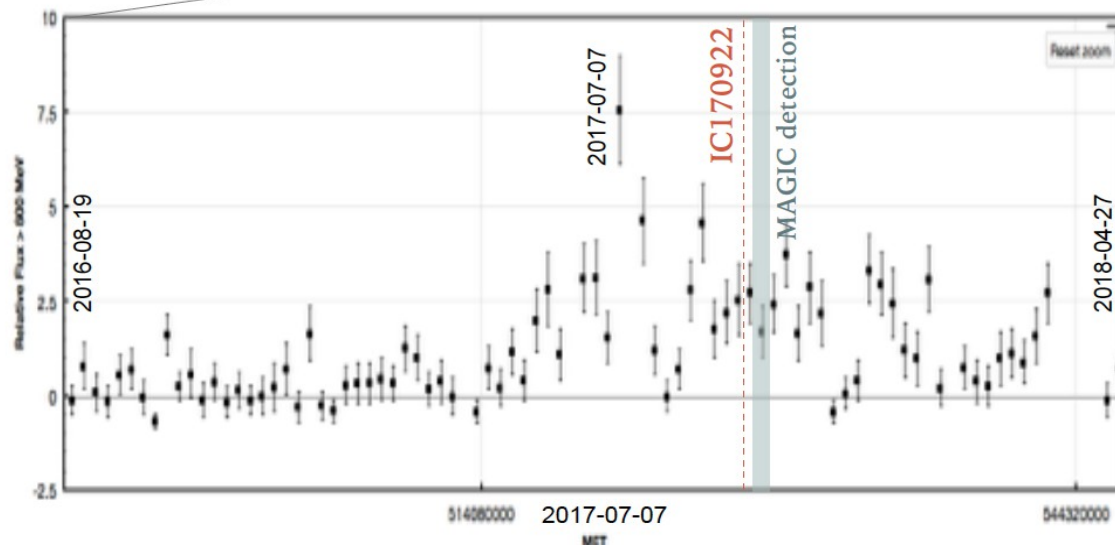


TXS0506+056 by FERMI



2008-08-08

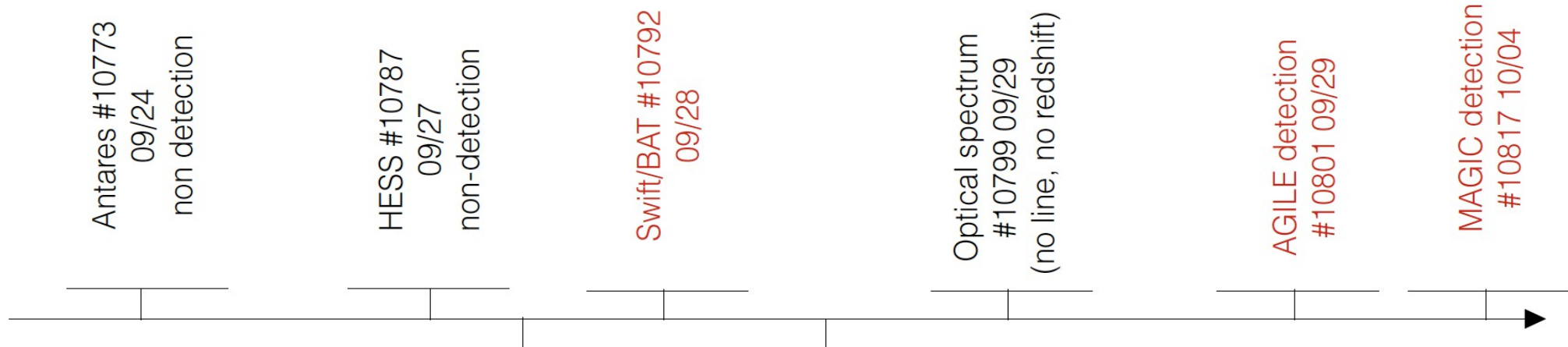
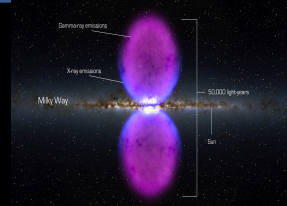
2018-04-27



A. Coleiro

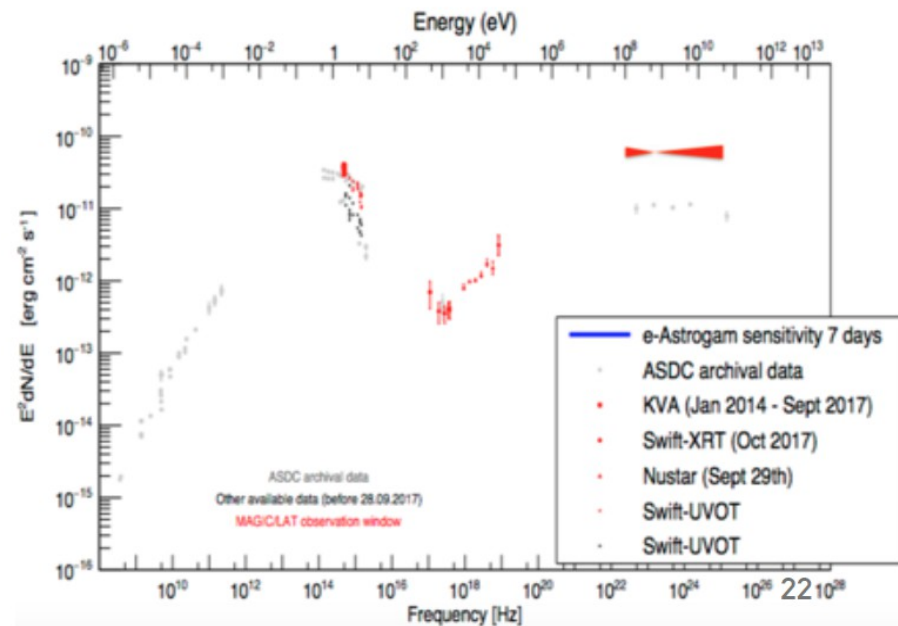


Campagne de suivi



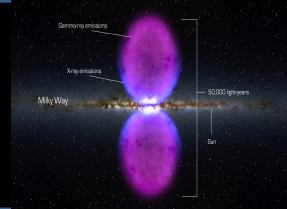
... and observations and reports by many more telescopes:
AGILE, ASAS-SN, Kapteyn, Kanata, Liverpool, Subaru,
VERITAS, VLA, X-Shooter, GTC, ...

A. Coleiro



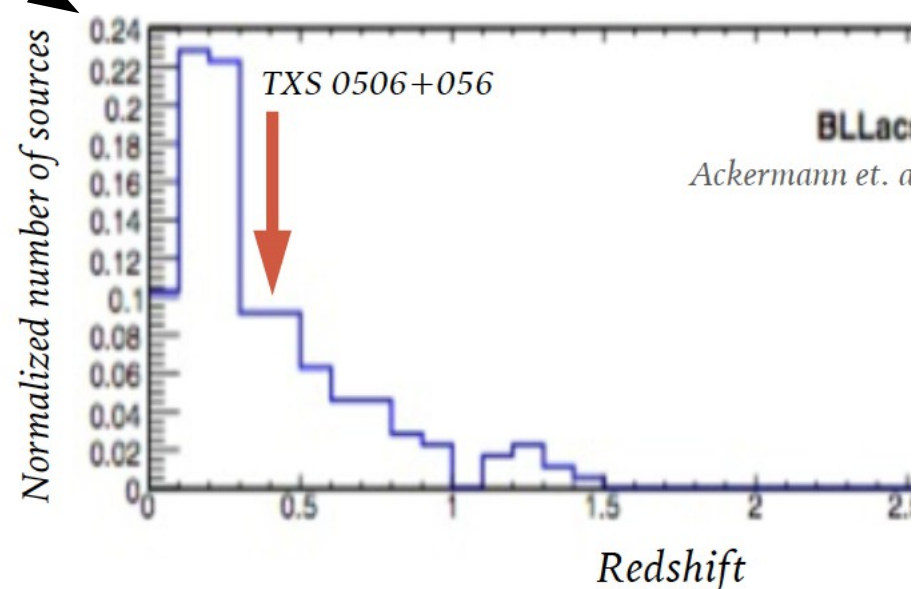
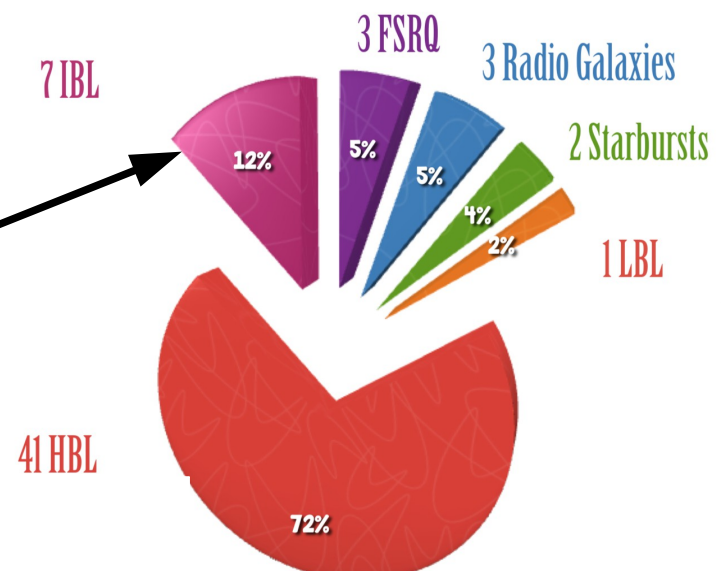
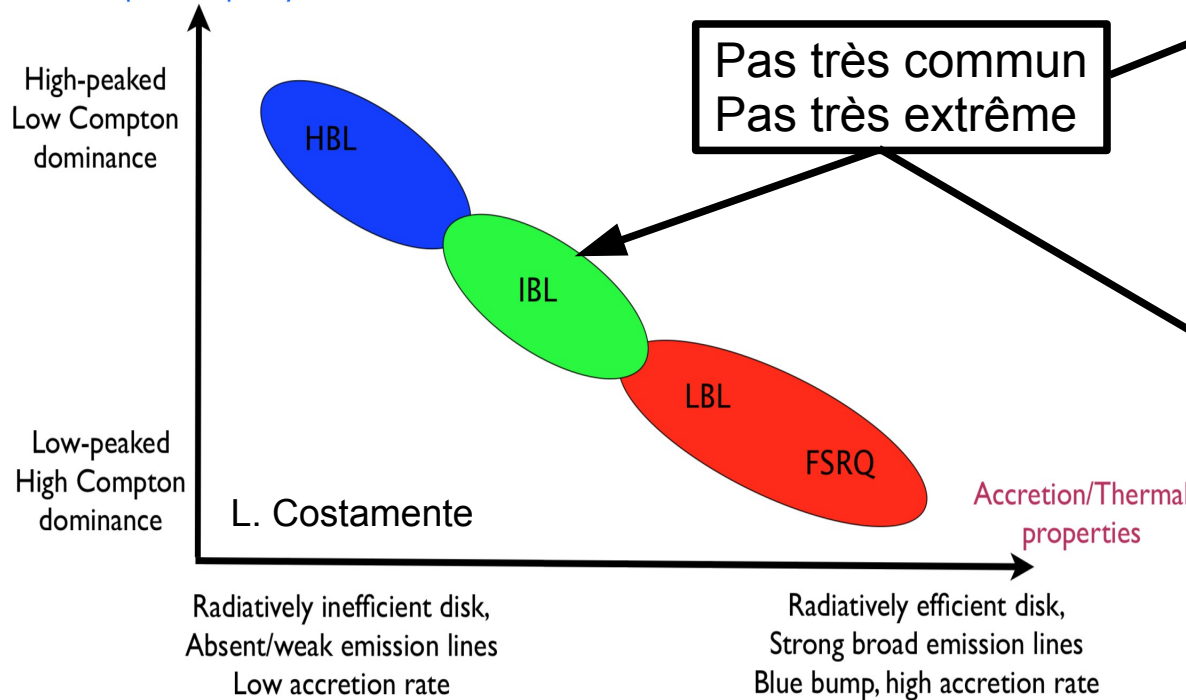


Quels blazars ?



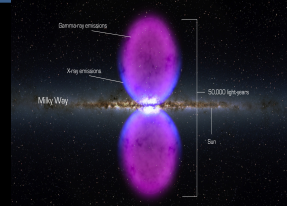
Blazars VHE gamma

Jet non-thermal properties
SED peak frequency



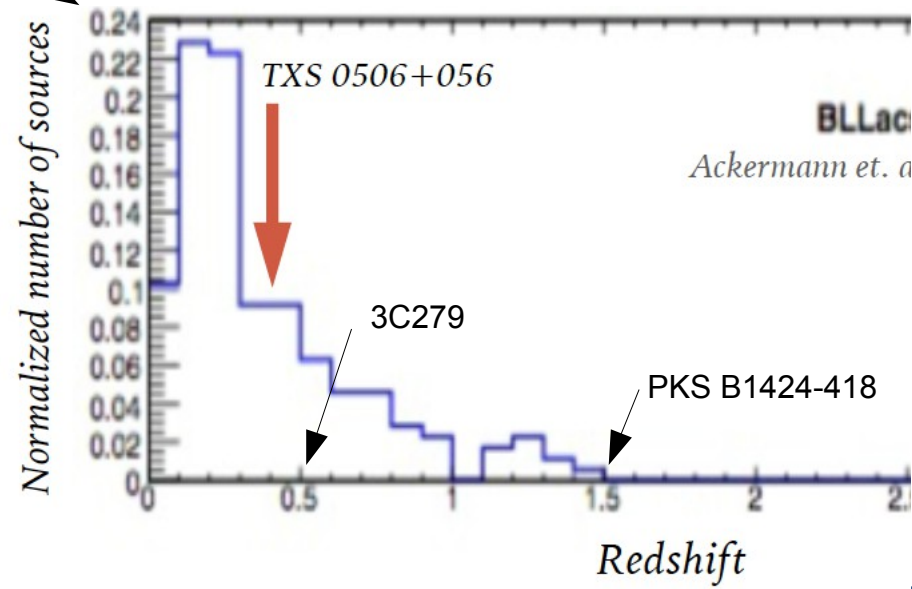
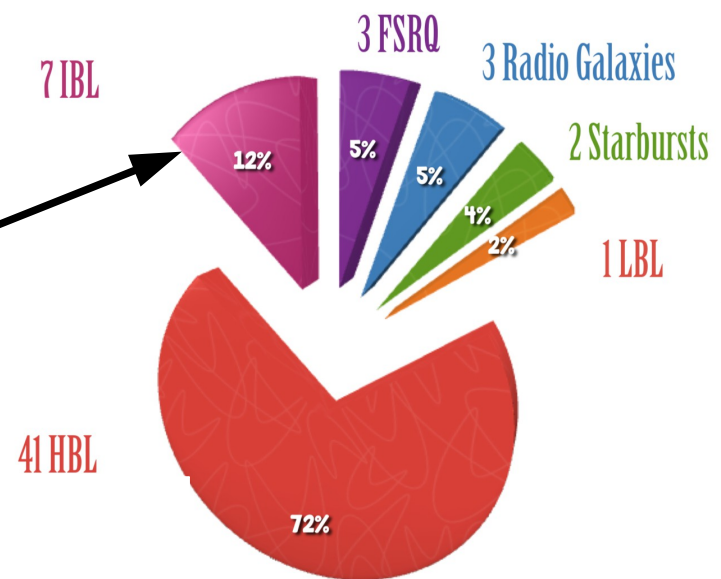
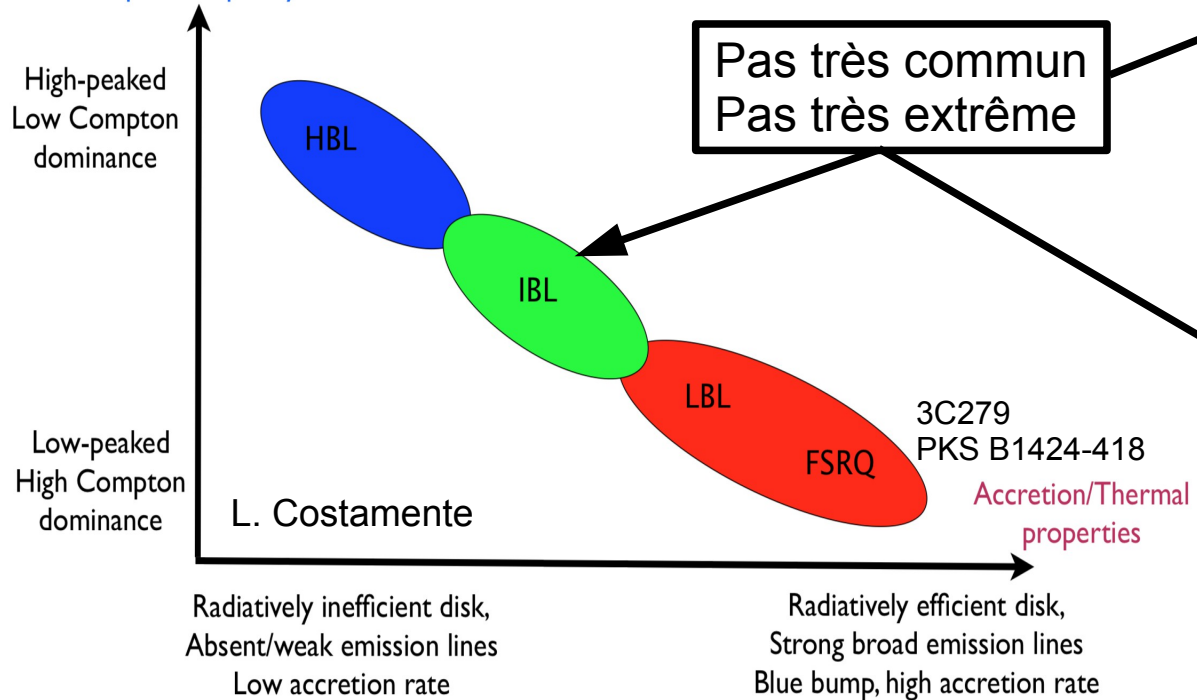


Quels blazars ?



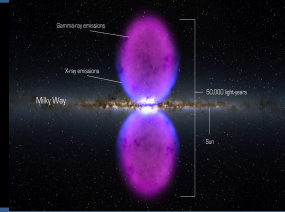
Blazars VHE gamma

Jet non-thermal properties
SED peak frequency

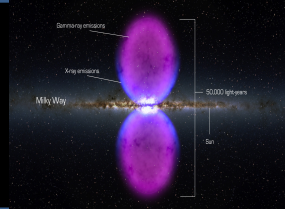




En somme

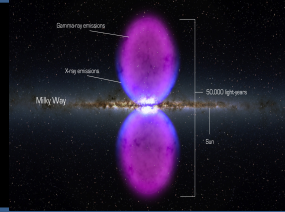


- Ingrédients :
 - Accélération de p ou noyaux → UHECR
 - Radiation ou Matière
 - Variabilité (<1s → mois)
 - Jets relativistes : micro-quasars, AGN, GRB
- Apports :
 - Zones opaques EM
 - Levée de dégénérescence lepto/hadro
 - Structure, composition, dynamique des Jets relativistes
- Aujourd'hui : Flux diffus vu, 1 source transitoire vue...
 - à l'année prochaine ! La physique arrive



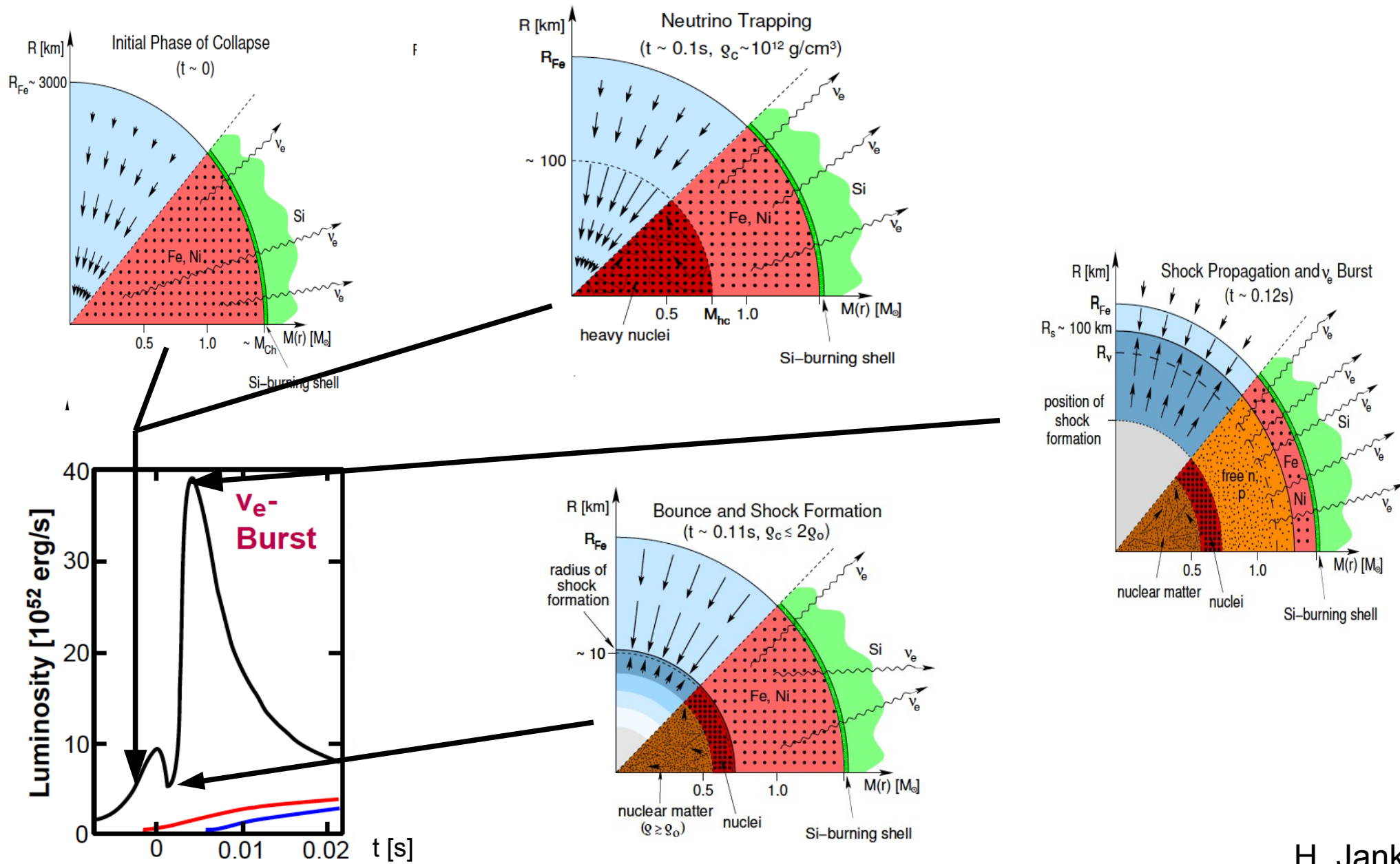
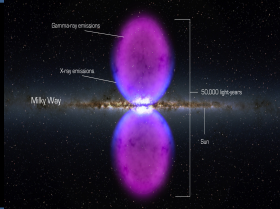


Du rab pour le fans de Super Novae





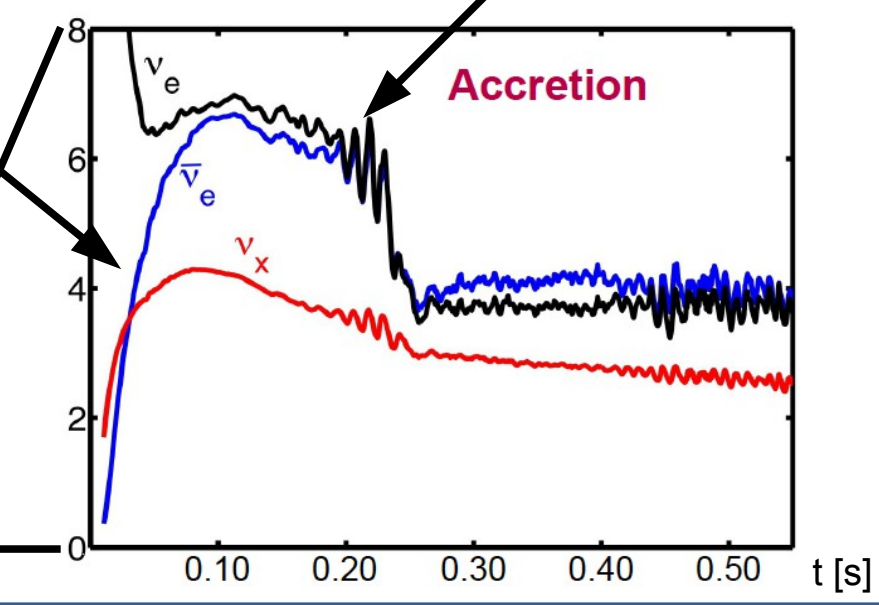
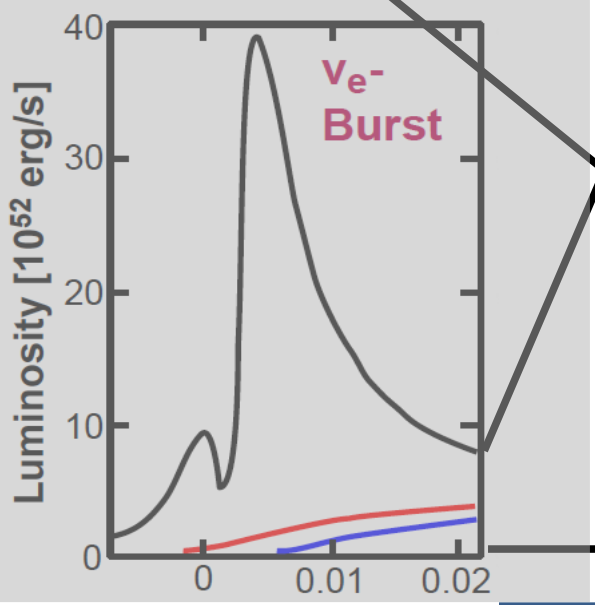
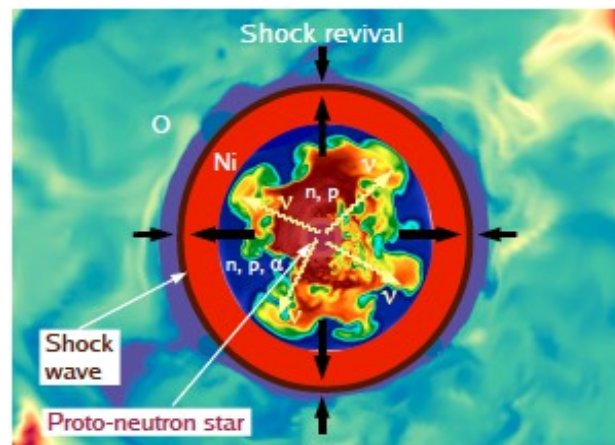
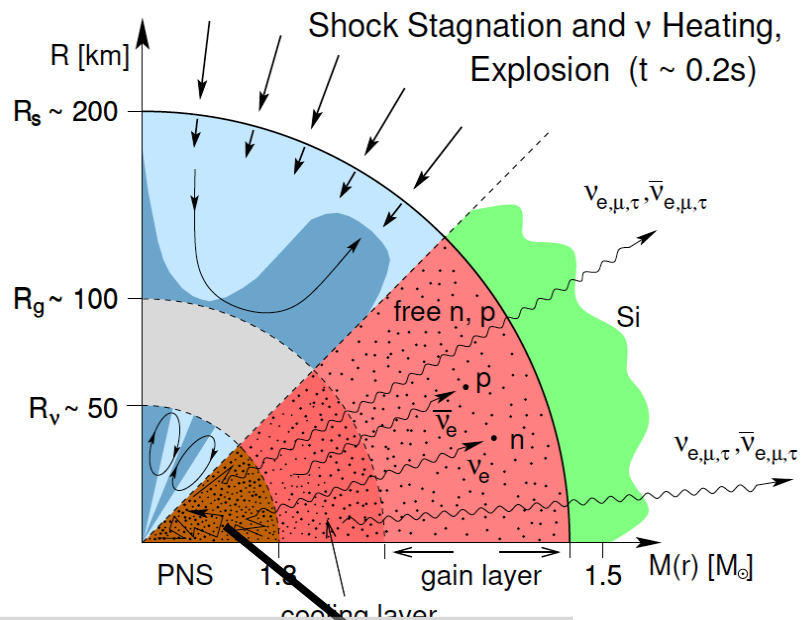
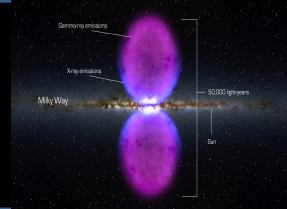
Supernovae - Phase I



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Supernovae – Phase II

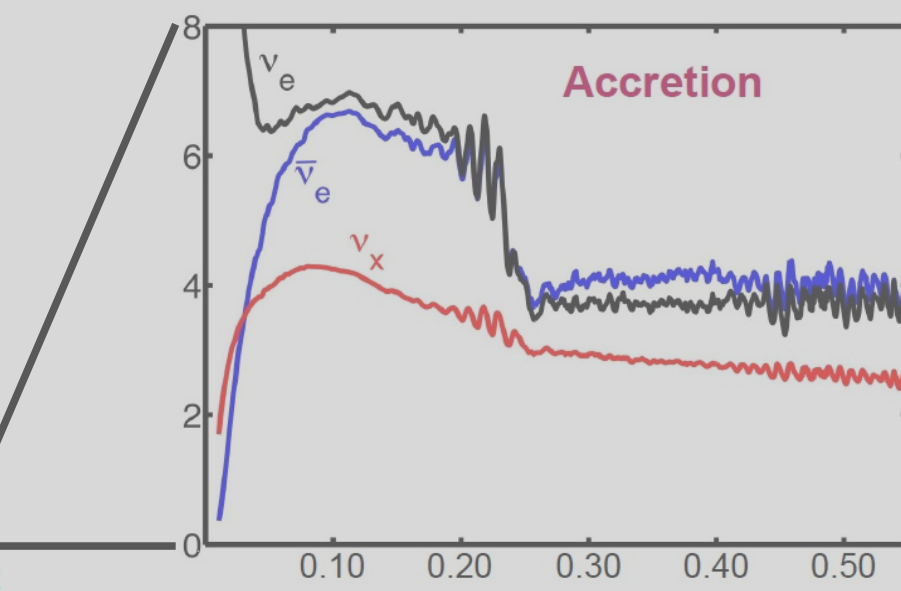
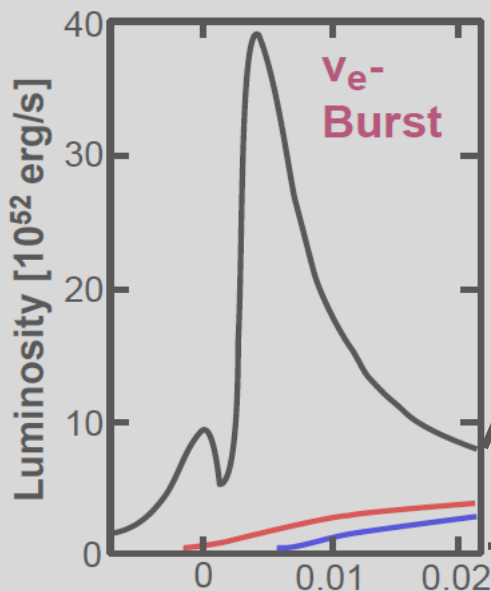
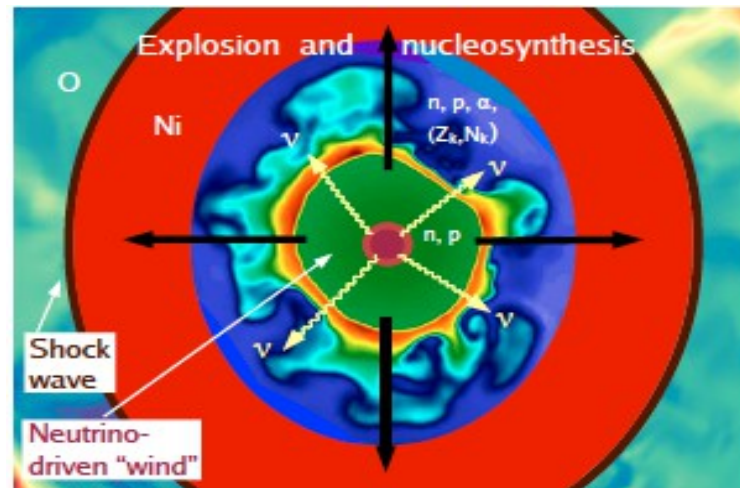
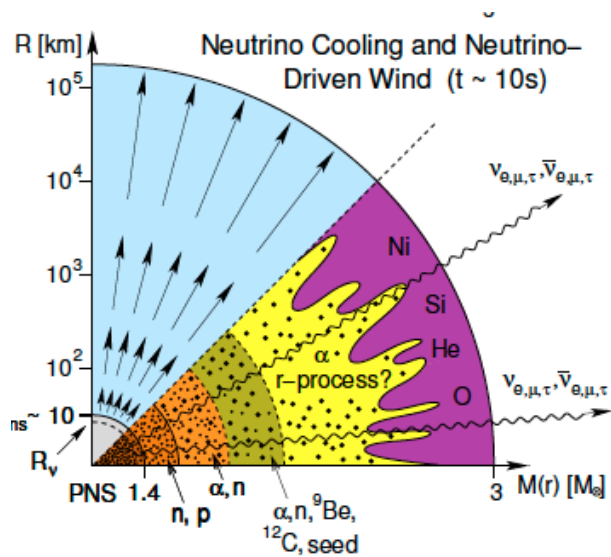
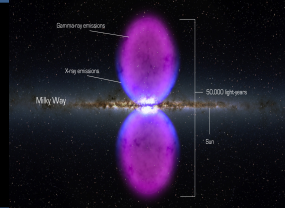


+ autres canaux

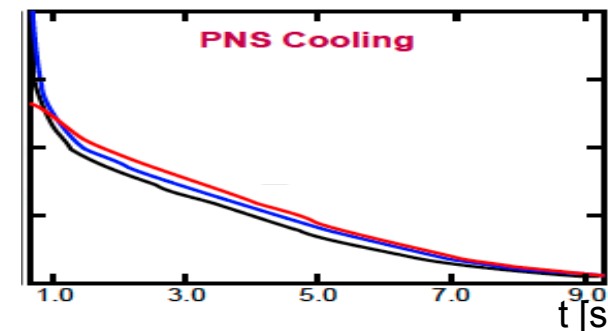
H. Janka



Supernovae – Phase III

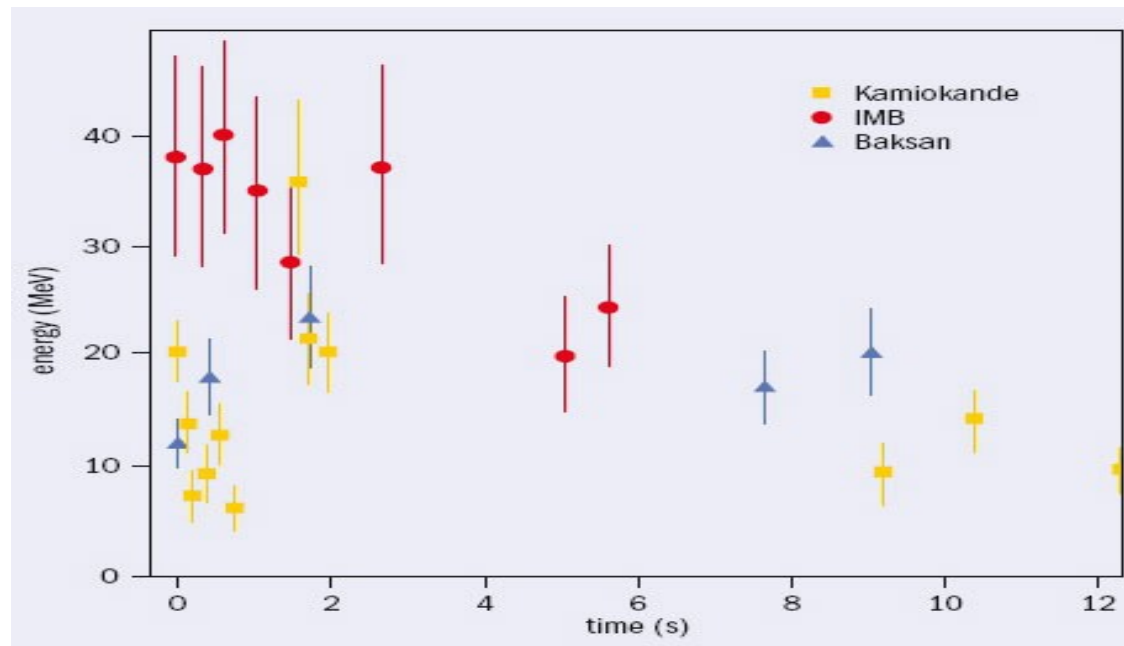
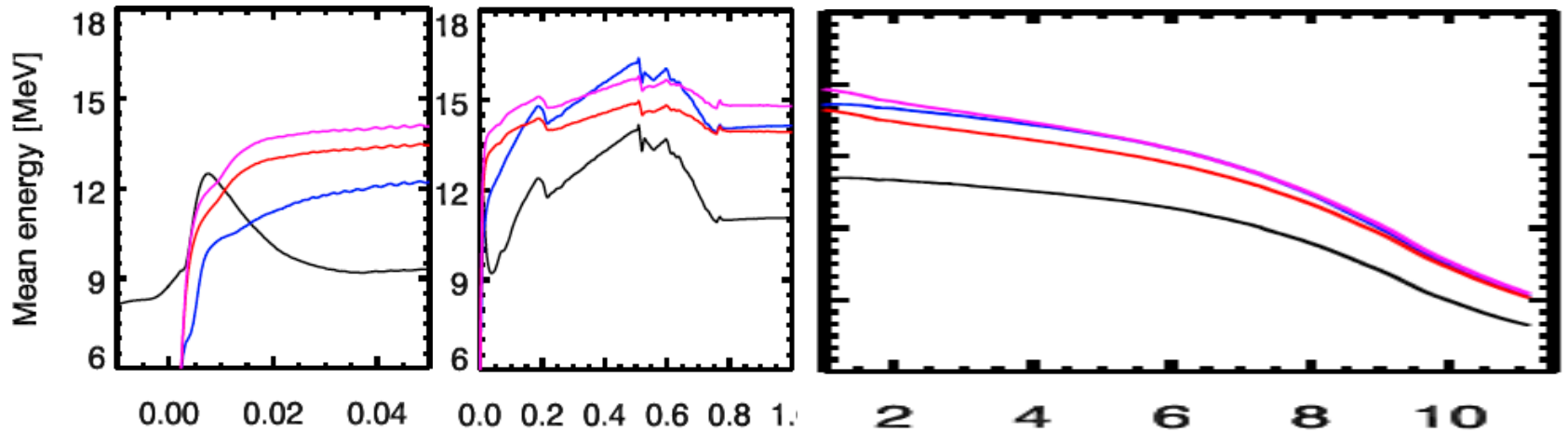
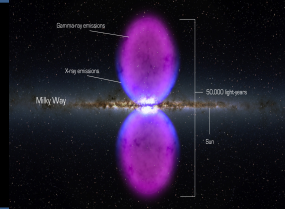


autres canaux





1987 A



NB : synchronisation
a posteriori