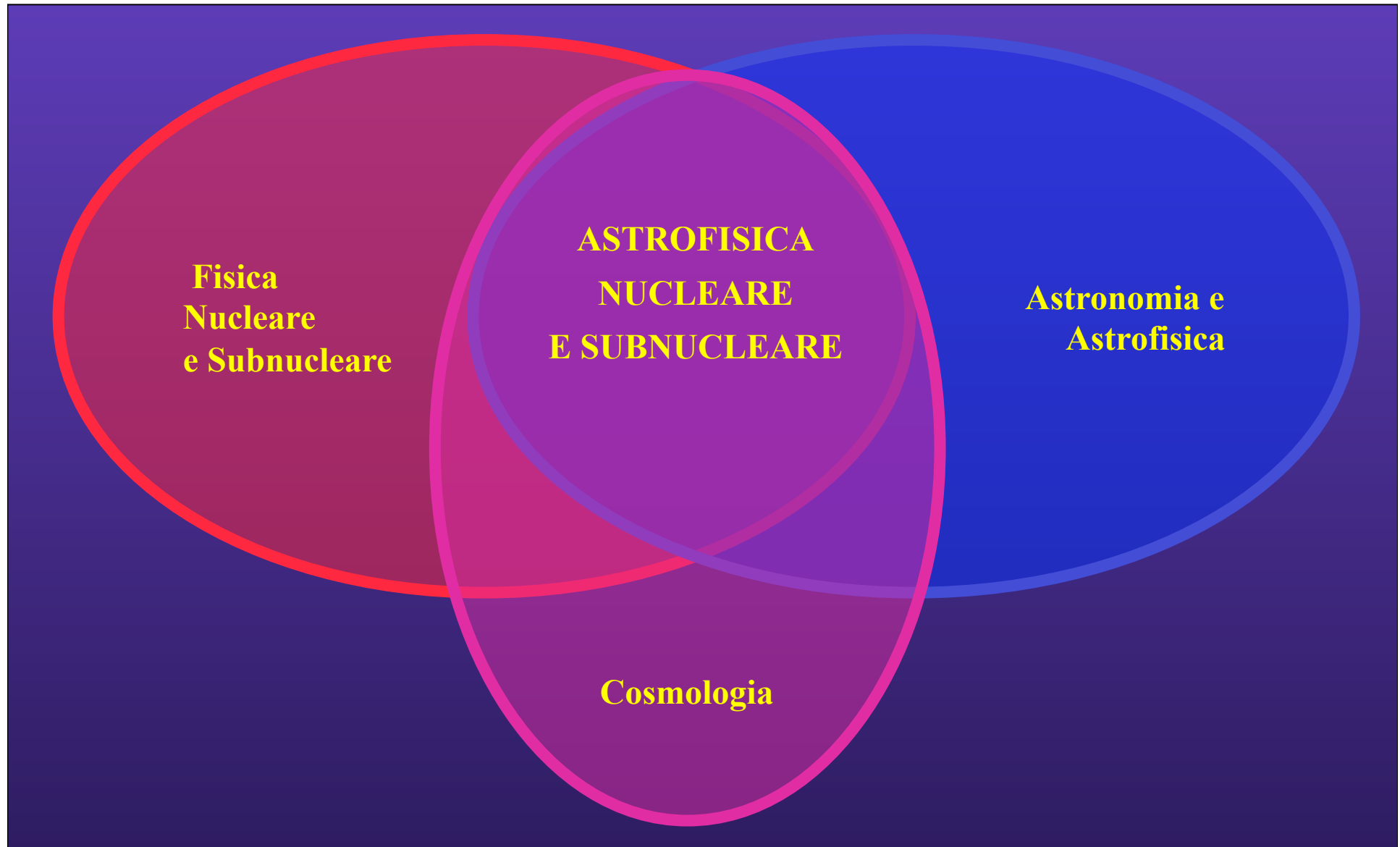


Astrofisica Nucleare e Subnucleare

Introduzione

Astrofisica Nucleare e Subnucleare

(Fisica Astroparticellare/Astrofisica Particellare)



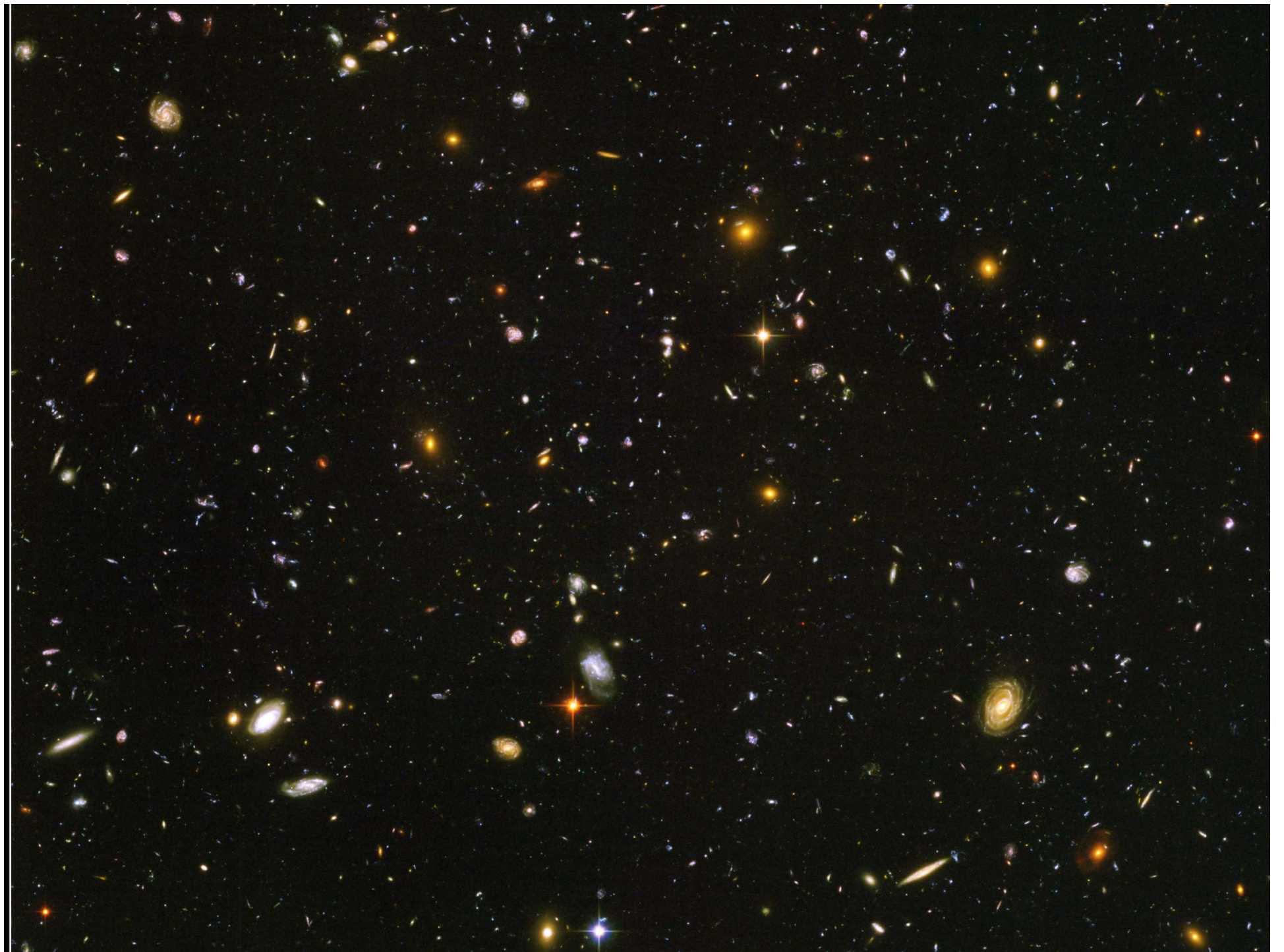


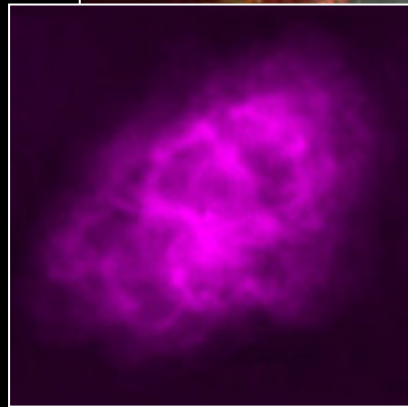
Tavola periodica degli elementi

Periodic Table of the Elements

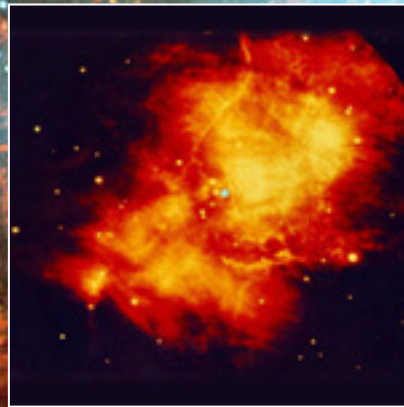
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La nebulosa del Granchio (Crab Nebula)

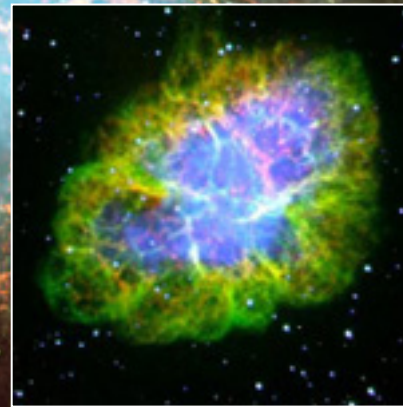
Supernova osservata dalla Cina nel 1054



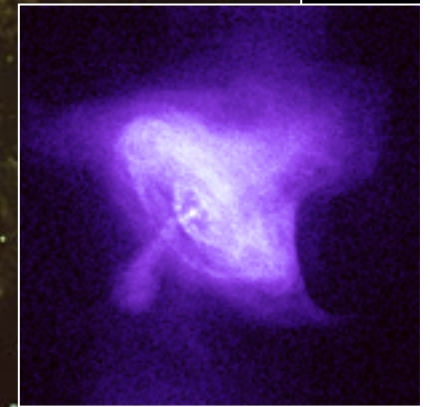
Radio



Infrarossi



Ottico



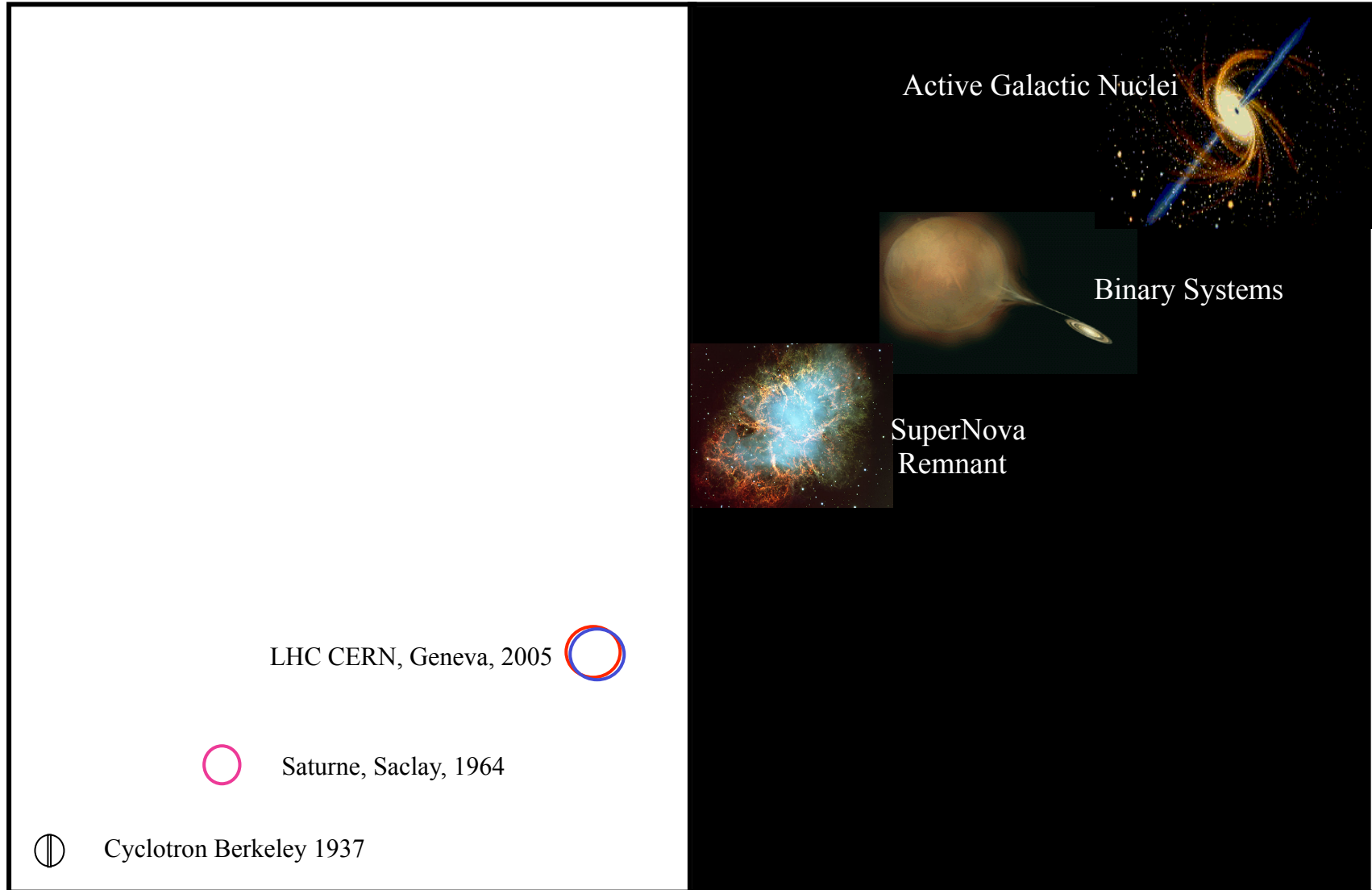
Raggi-X

Fisica Nucl. e S. $\Rightarrow$ Astrofisica Nucl. e S.

Acceleratori Terrestri

Acceleratori Cosmici

Diametro dell'acceleratore

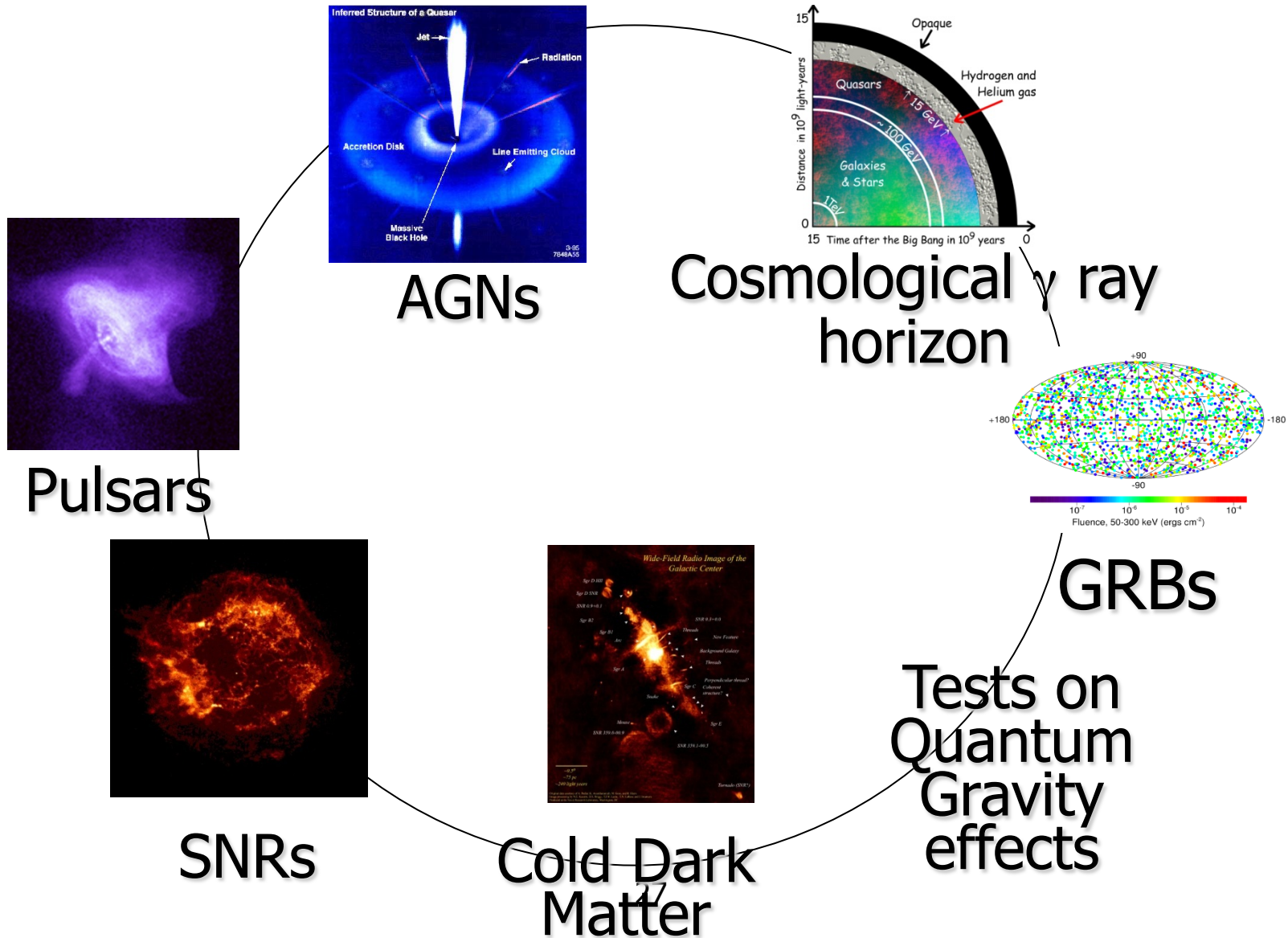


Energia delle particelle accelerate

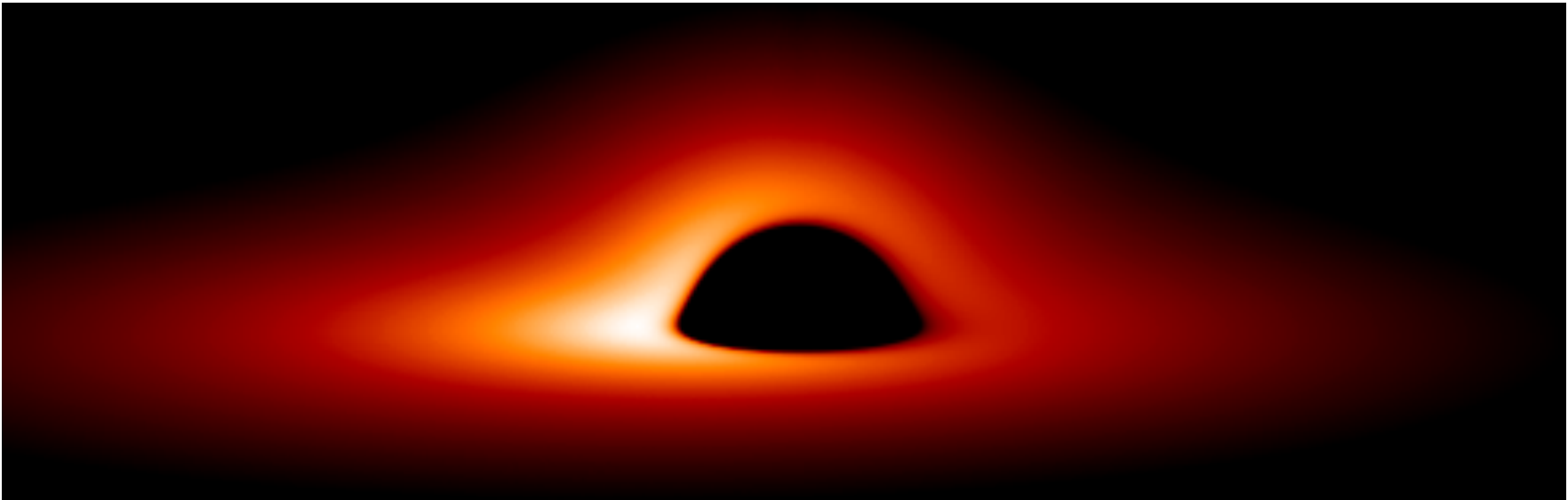
Astrofisica Nucleare e Subnucleare

Astrofisica Gamma – Overview

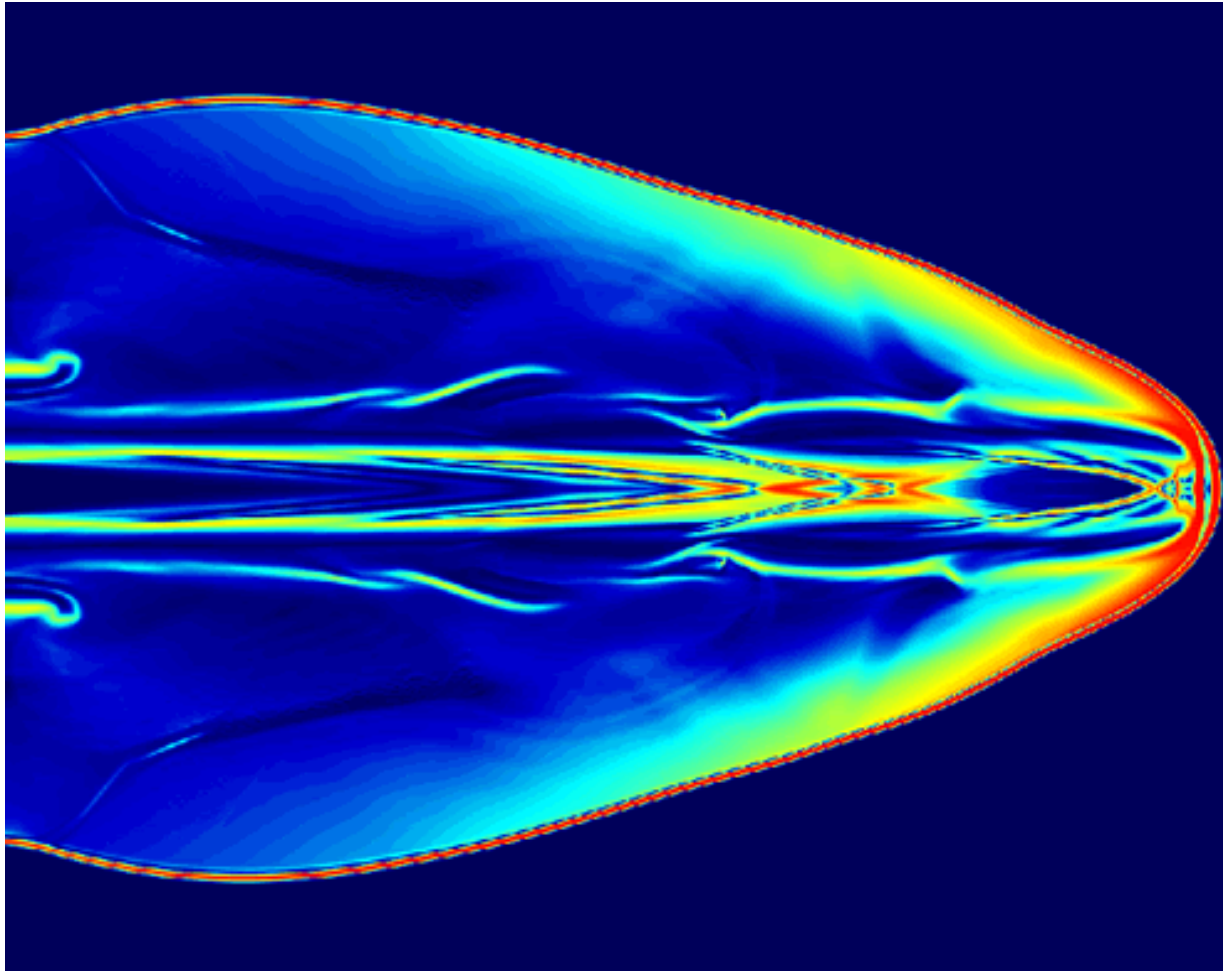
Science Objectives



Compact objects



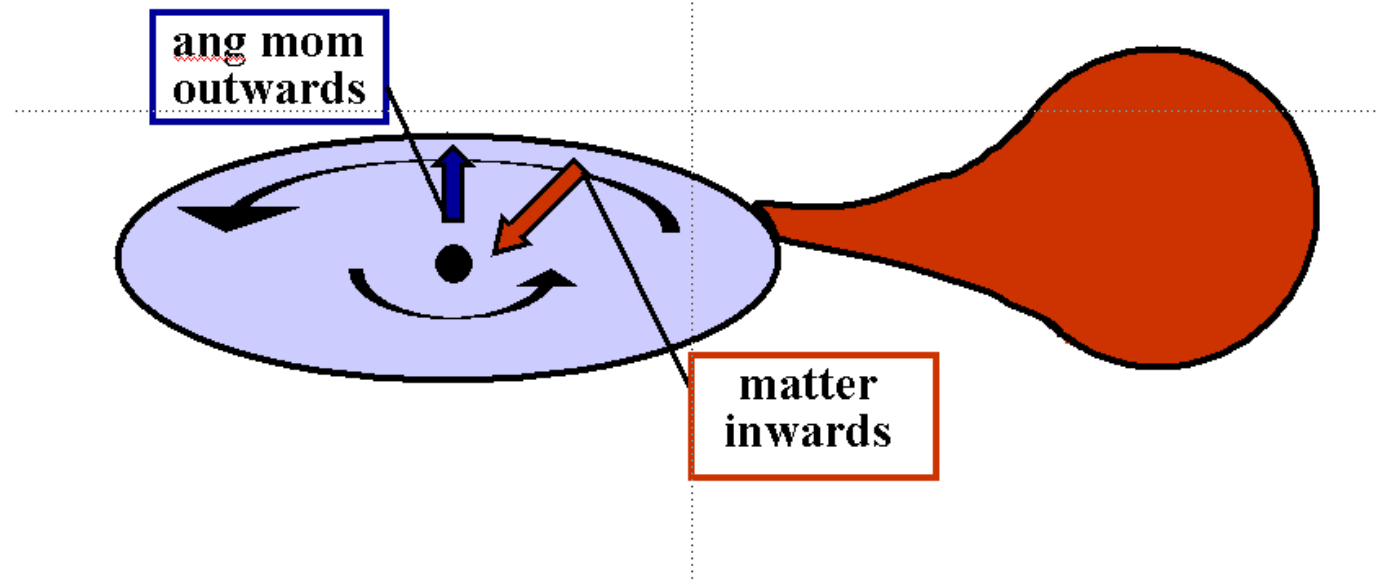
Jets



Accretion

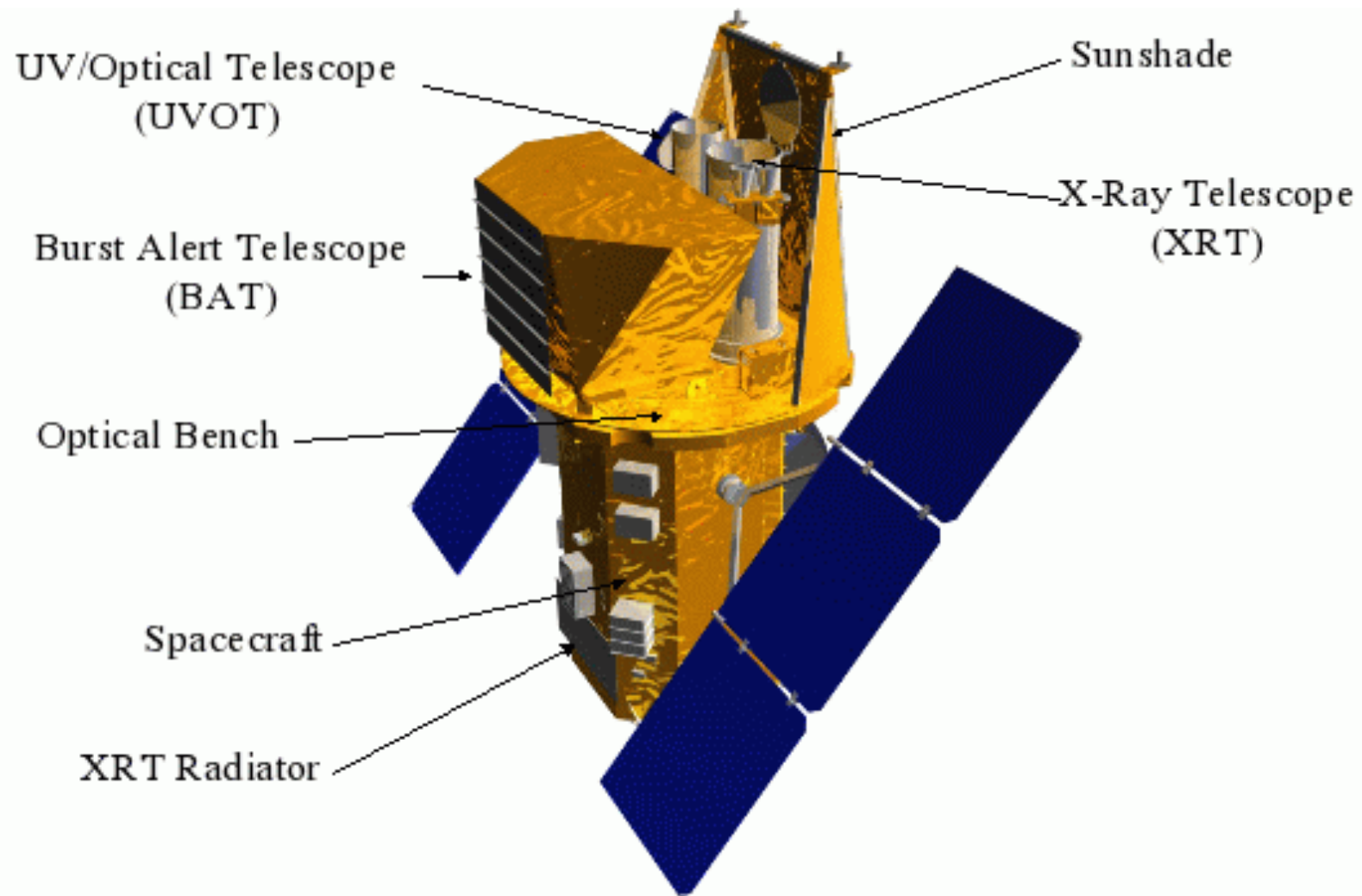
Accretion disk formation

Matter circulates around the compact object:

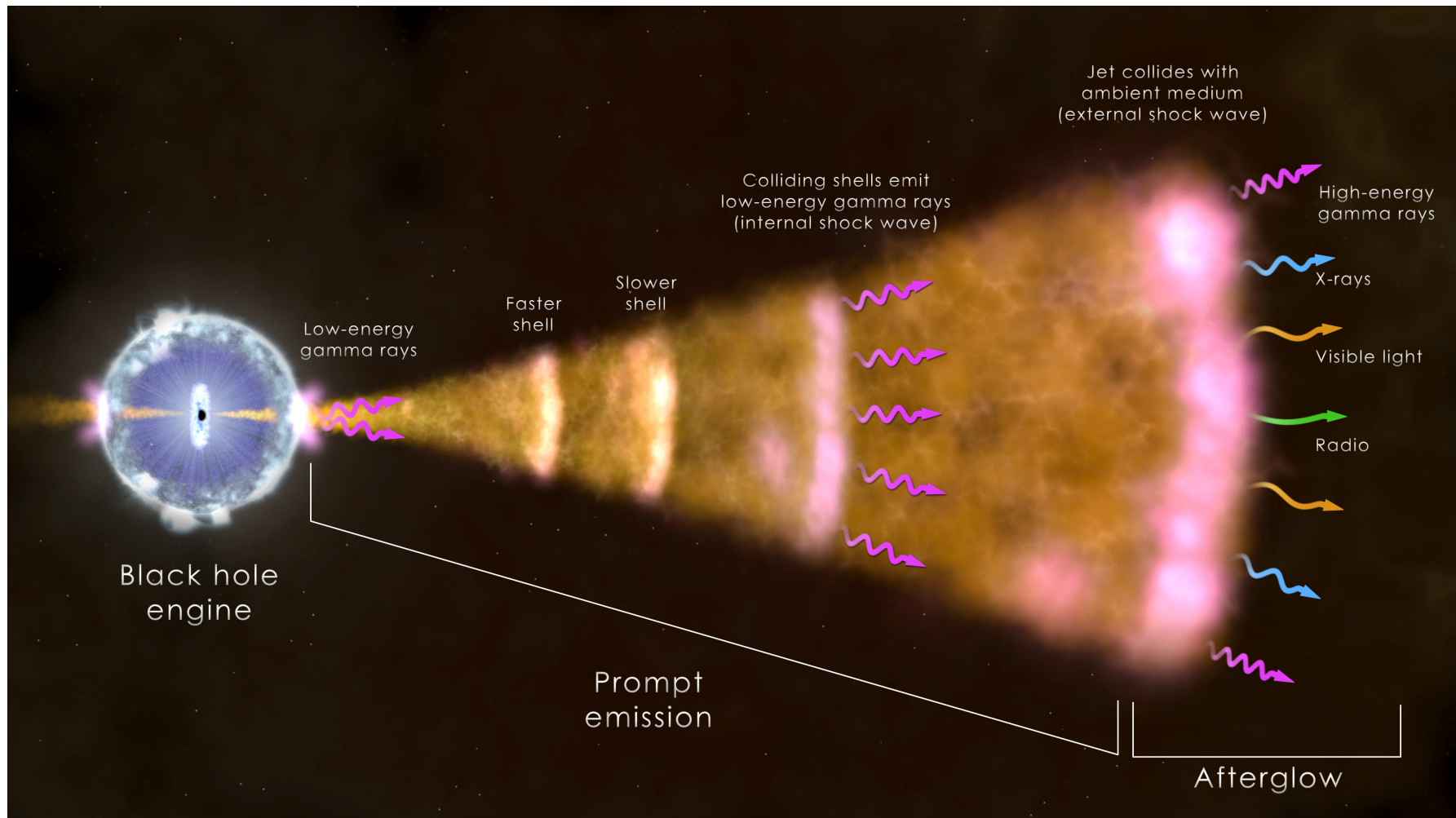


keV-MeV gamma-ray astrophysics

Swift



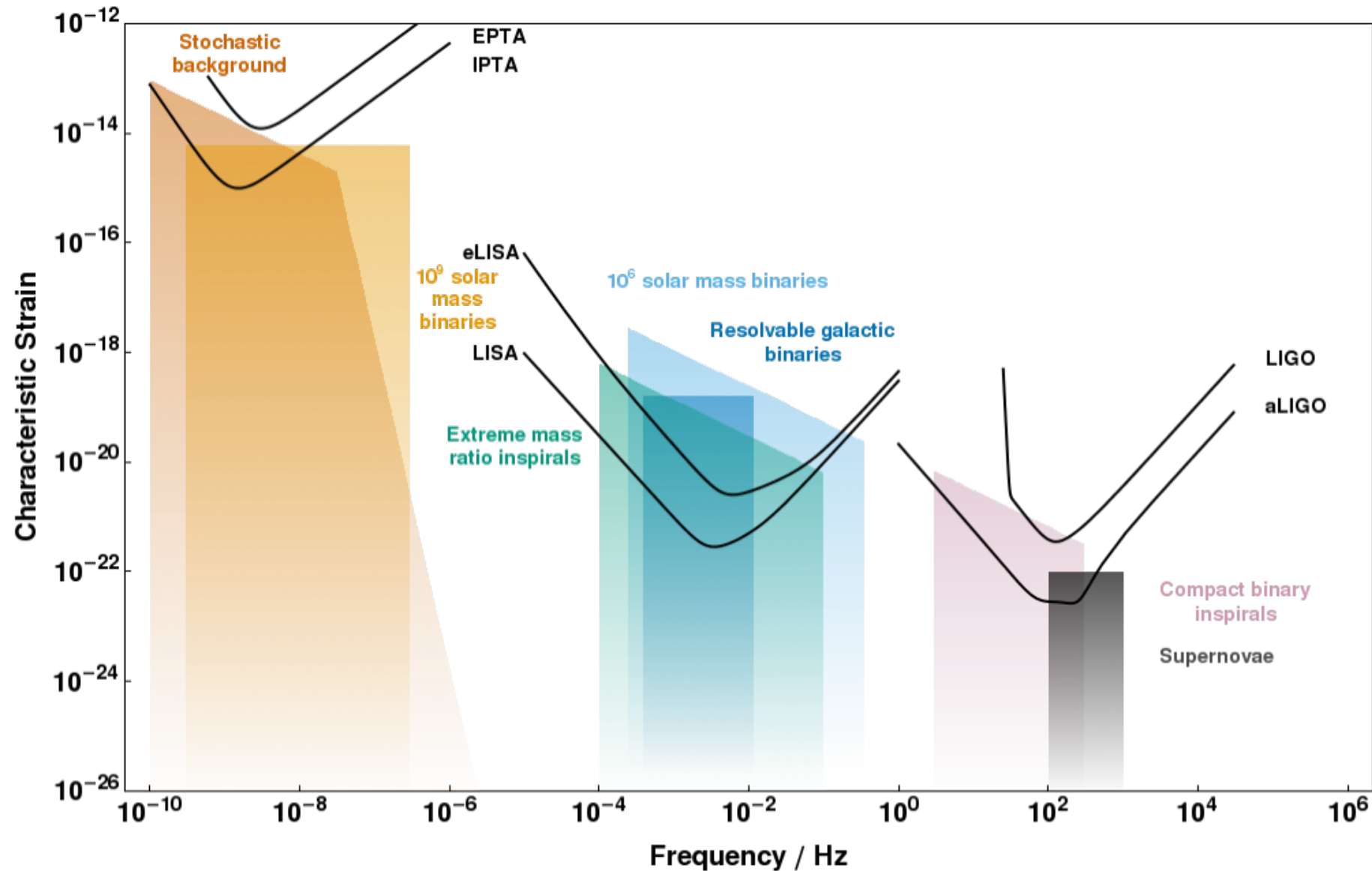
GRB



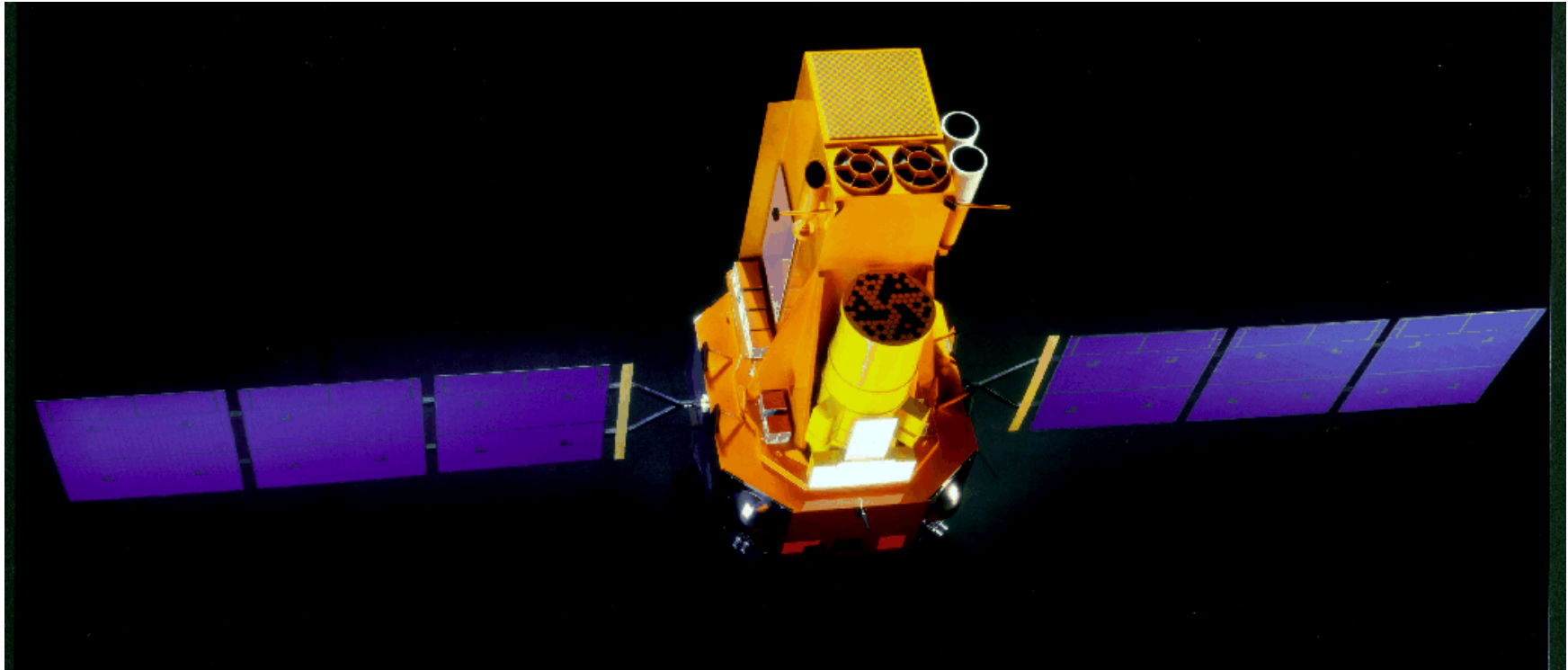
Gravitational Waves



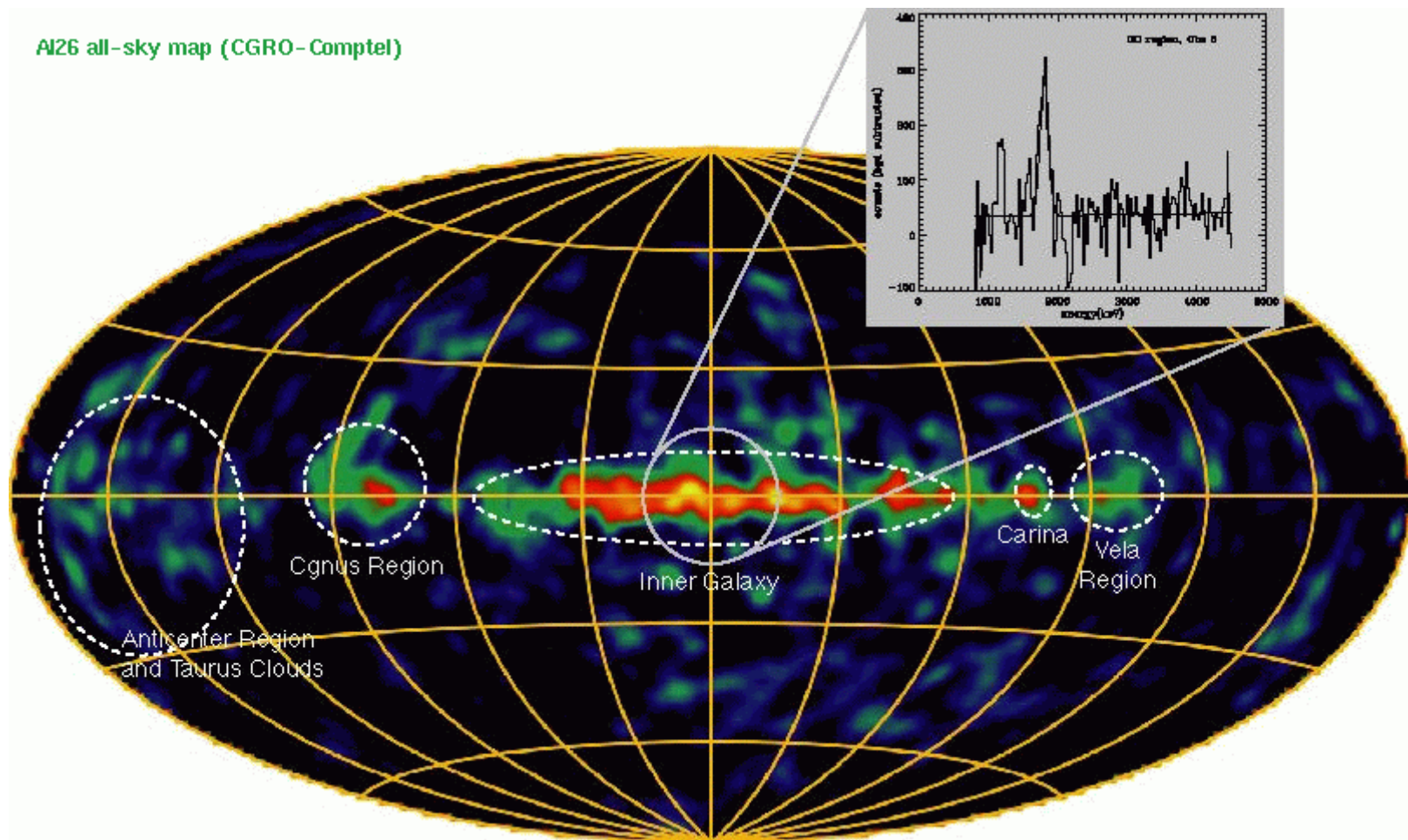
Gravitational Waves



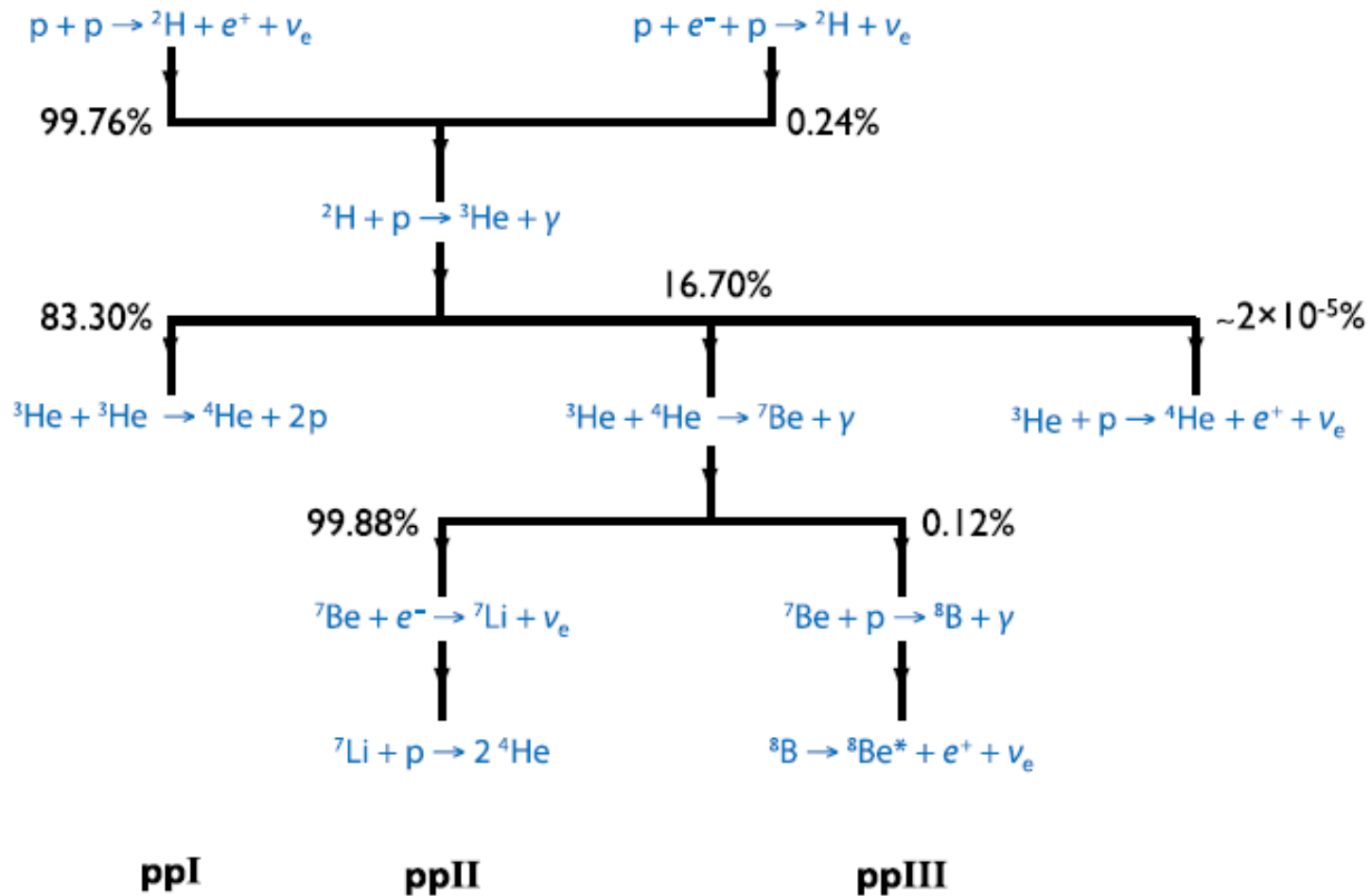
INTEGRAL



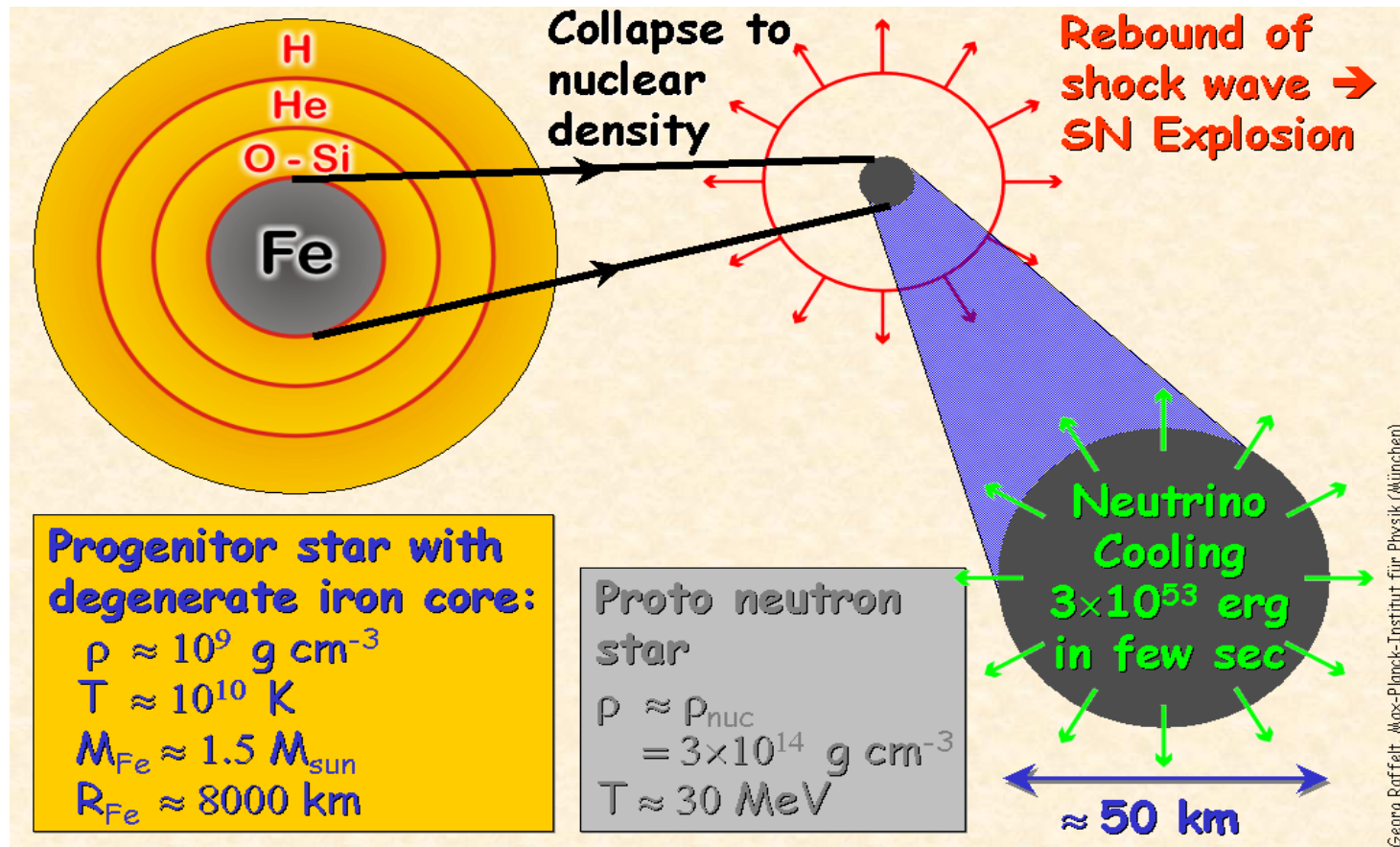
INTEGRAL



Solar Thermonuclear Cycles



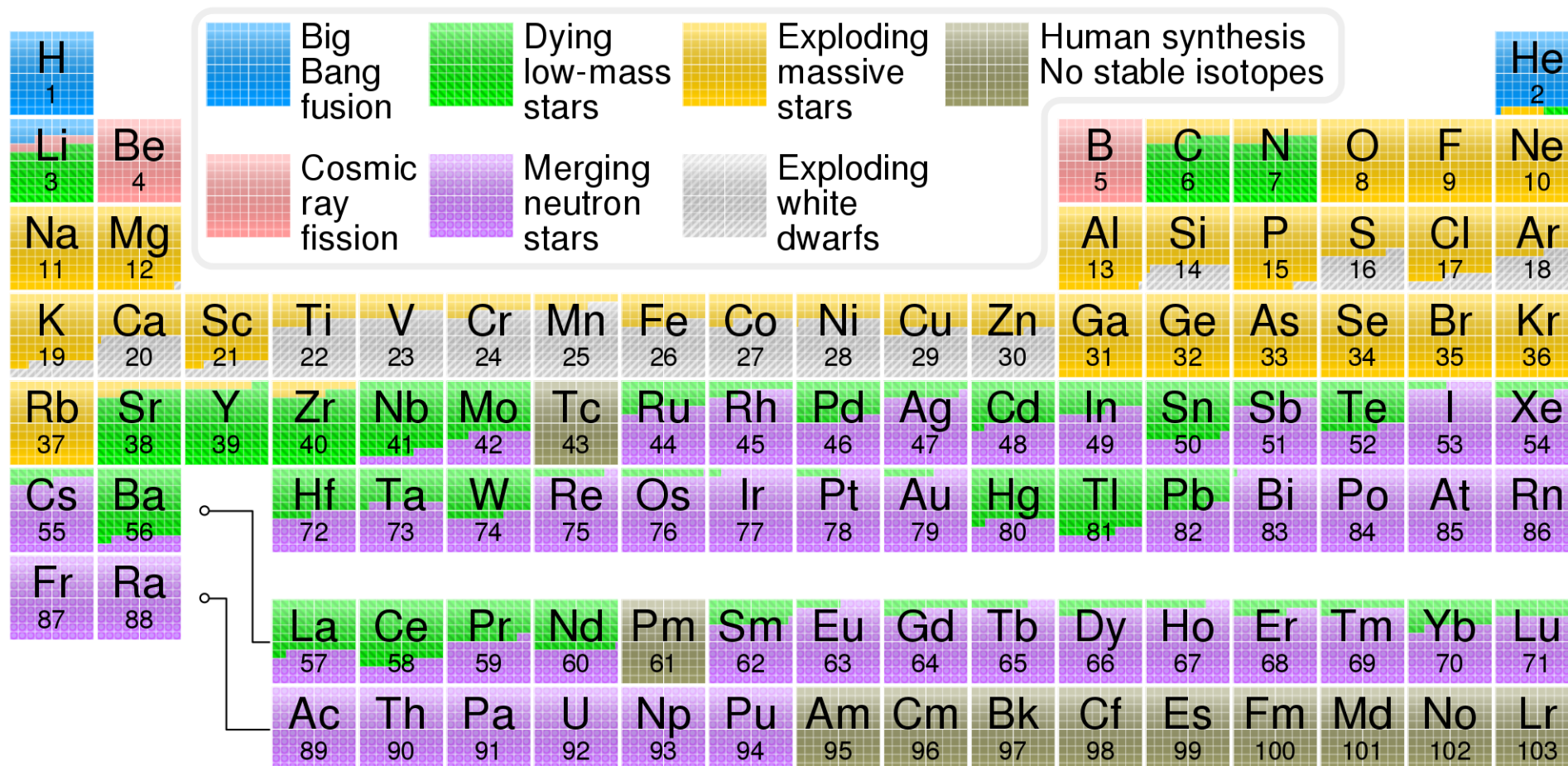
Stellar collapse and neutrinos



H B	B Big Bang L Large stars \$ Super-novae C Cosmic rays S Small stars M Man-made																He B						
Li C	Be C																	B C	C S L	N S L	O S L	F L	Ne S L
Na L	Mg L																	Al \$ L	Si \$ L	P L	S S L	Cl L	Ar L
K L	Ca L	Sc L	Ti \$ L	V \$ L	Cr L	Mn L	Fe \$ L	Co \$	Ni \$	Cu L	Zn L	Ga \$	Ge \$	As L	Se \$	Br \$	Kr \$						
Rb \$	Sr L	Y L	Zr L	Nb L	Mo \$ L	Tc L	Ru \$ L	Rh \$	Pd \$ L	Ag \$ L	Cd \$ L	In \$ L	Sn \$ L	Sb \$	Te \$	I \$	Xe \$						
Cs \$	Ba L	○ ○	Hf \$ L	Ta \$ L	W \$ L	Re \$	Os \$	Ir \$	Pt \$	Au \$	Hg \$ L	Tl \$ L	Pb \$	Bi \$	Po \$	At \$	Rn \$						
Fr \$	Ra \$		La L	Ce L	Pr \$ L	Nd \$ L	Pm \$ L	Sm \$ L	Eu \$	Gd \$	Tb \$	Dy \$	Ho \$	Er \$	Tm \$	Yb \$ L	Lu \$						
			Ac \$	Th \$	Pa \$	U \$	Np \$	Pu \$	Am M	Cm M	Bk M	Cf M	Es M	Fm M	Md M	No M	Lr M						

Credit: Wikipedia: Cmglee

Credit: Wikipedia: Cmglee



Dopo GW 170817

GeV gamma-ray astrophysics

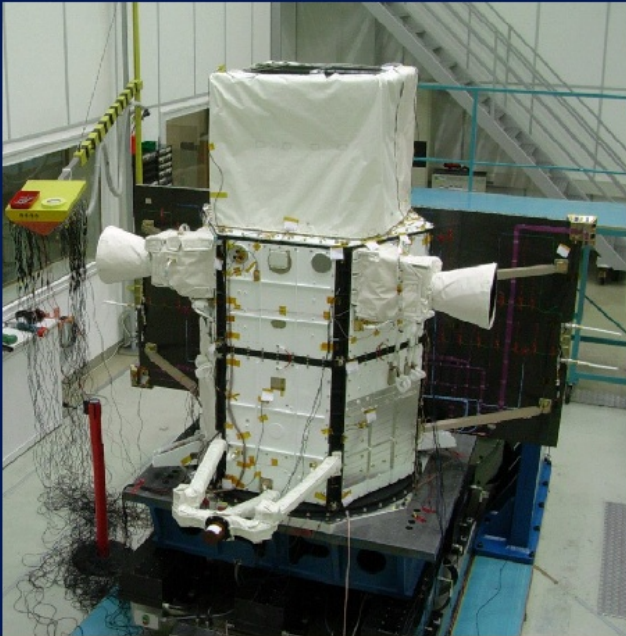
AGILE



The top banner features a 3D rendering of the AGILE satellite in space, with its solar panels and instruments visible. The satellite is positioned above a bright, fiery band of light, possibly representing a gamma-ray source or a nebula. The word "agile" is written in a stylized, italicized font to the right of the satellite.

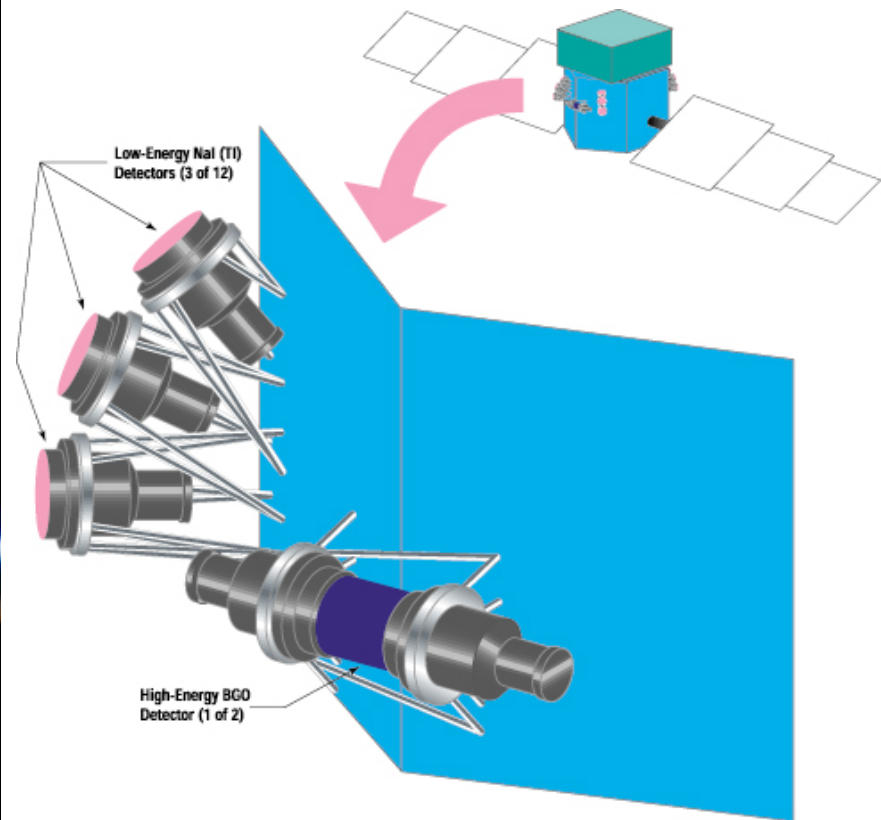
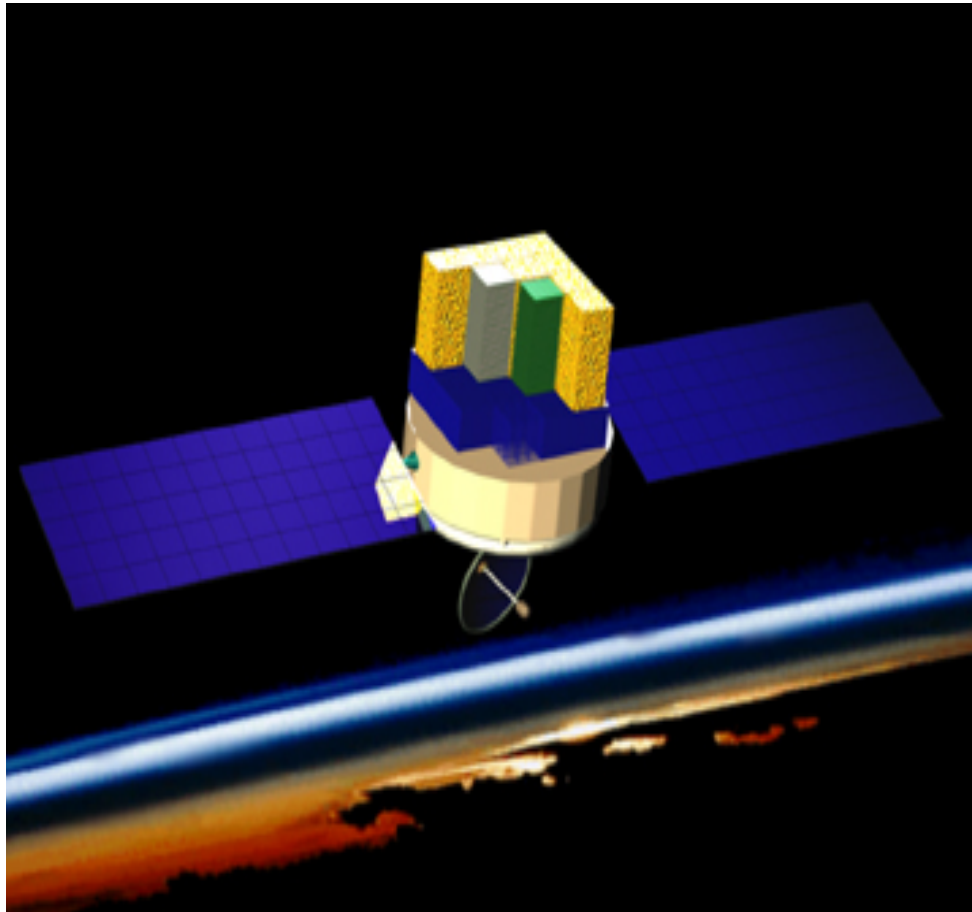
Astro-rivelatore Gamma a Immagini LEggero

Home	
AGILE Team	
AGILE System Team	
AGILE in ASI	
AGILE Industrial Partners	
AGILE Progress Status	
Science with AGILE	
AGILE Sensitivity	
AGILE Selected Publications	
AGILE latest review paper	
Highlights	
Education & Public Outreach	
Public Information	
AGILE Site	

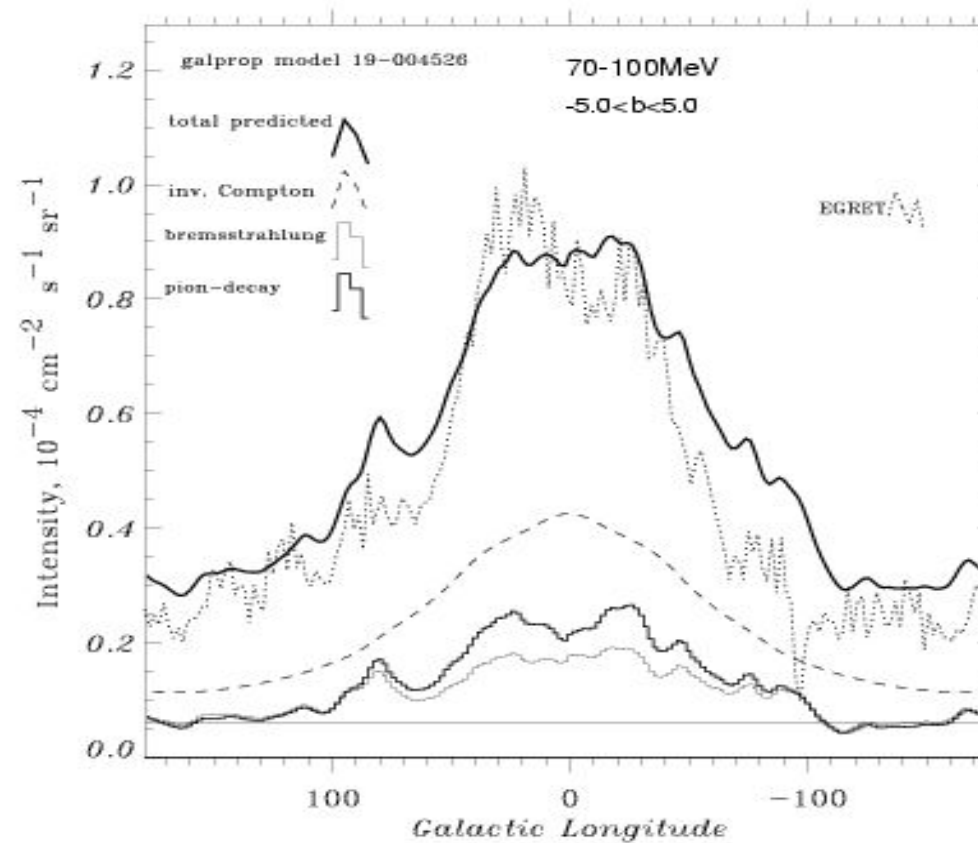


A photograph of the AGILE satellite in a laboratory setting. The satellite is a complex, white, box-like structure with various instruments and sensors attached. It is mounted on a blue base and surrounded by cables and equipment. The background shows a laboratory environment with stairs and other equipment.

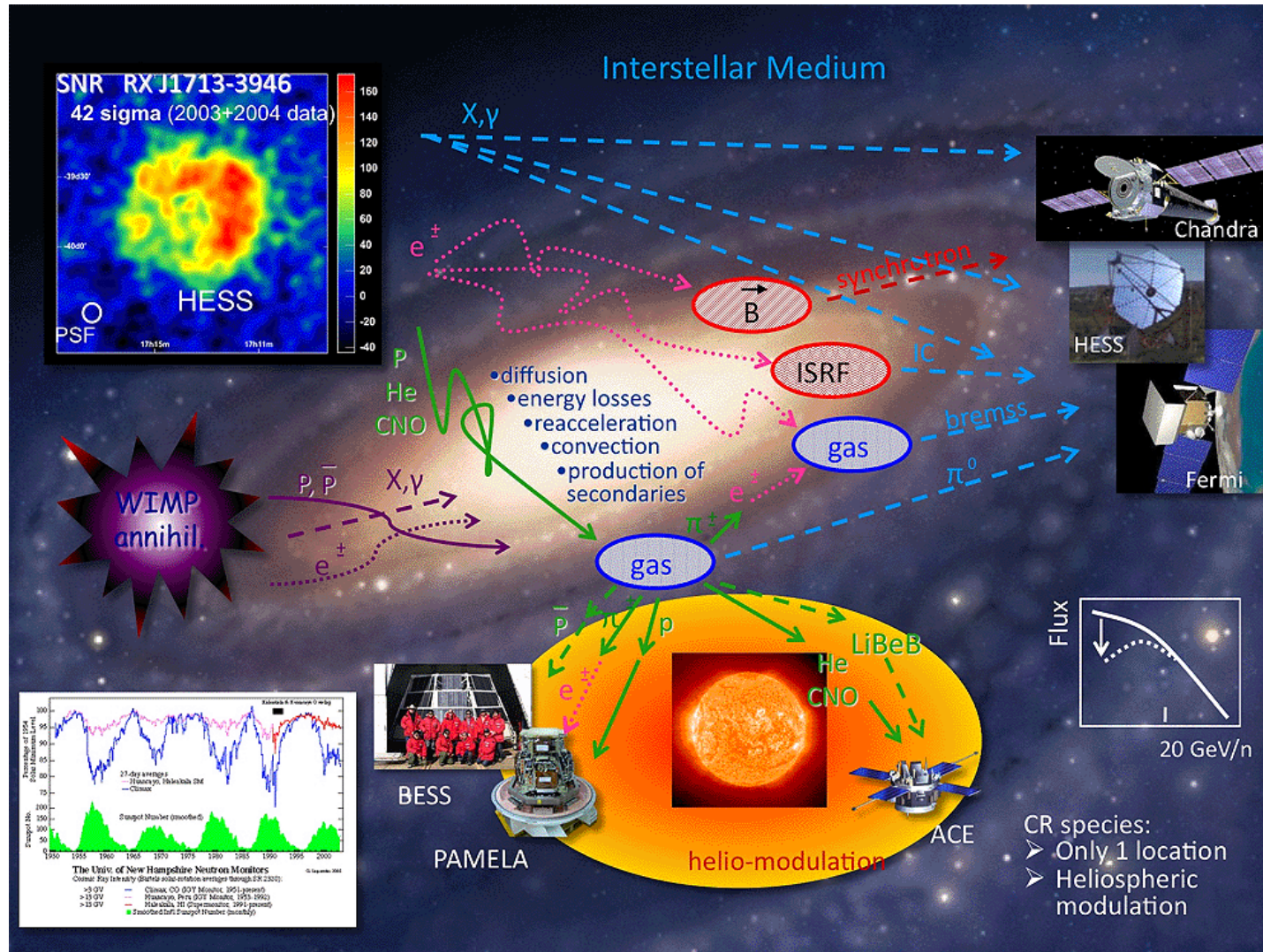
Fermi/GLAST



The galactic plane



Cosmic Rays Propagation

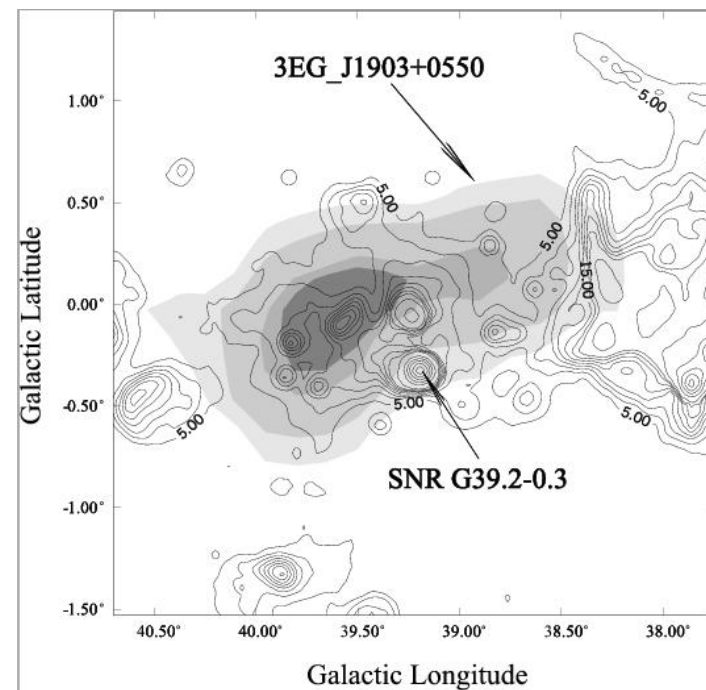
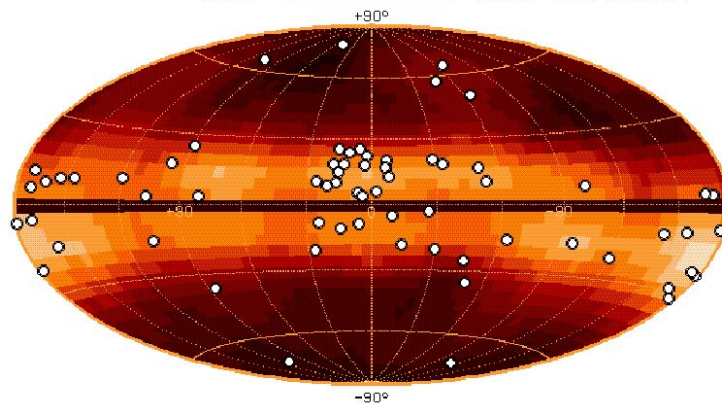
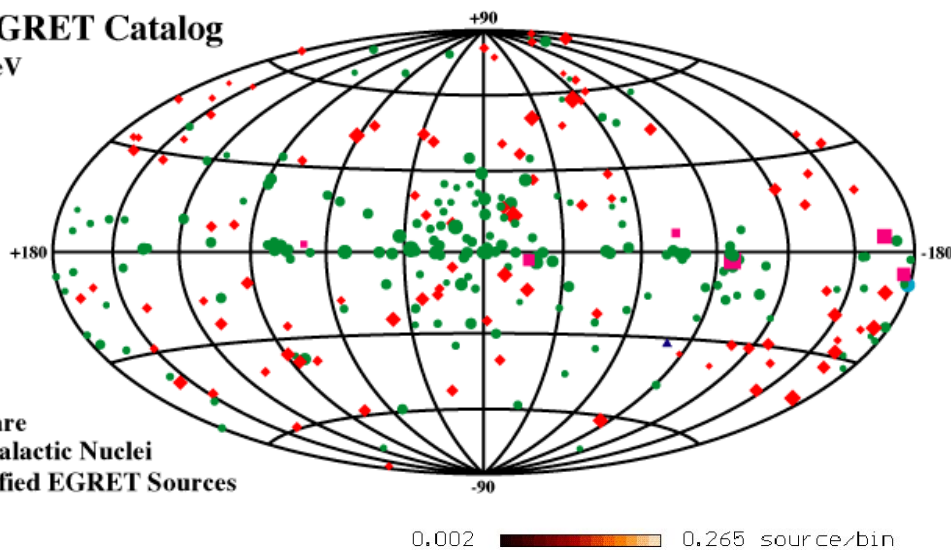


Unidentified Gamma-Ray Sources

Third EGRET Catalog

$E > 100$ MeV

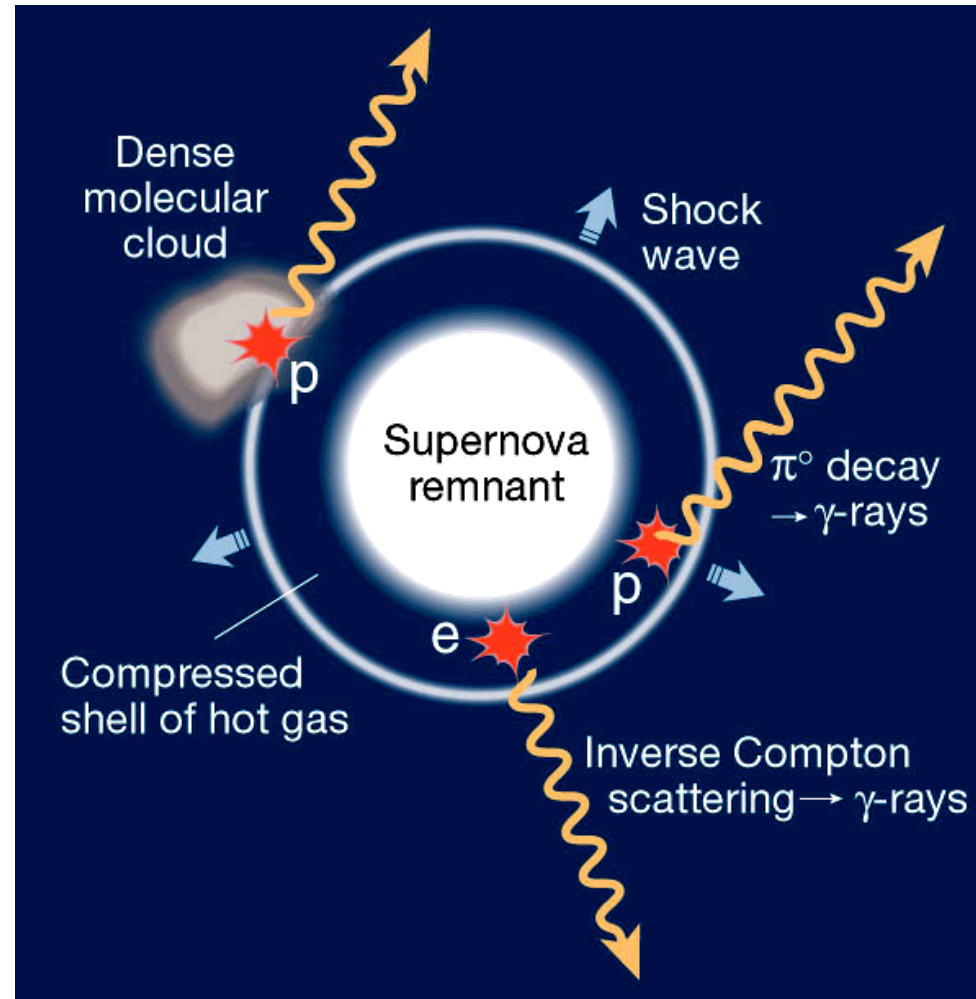
- ▲ LMC
- Pulsars
- Solar Flare
- ◆ Active Galactic Nuclei
- Unidentified EGRET Sources



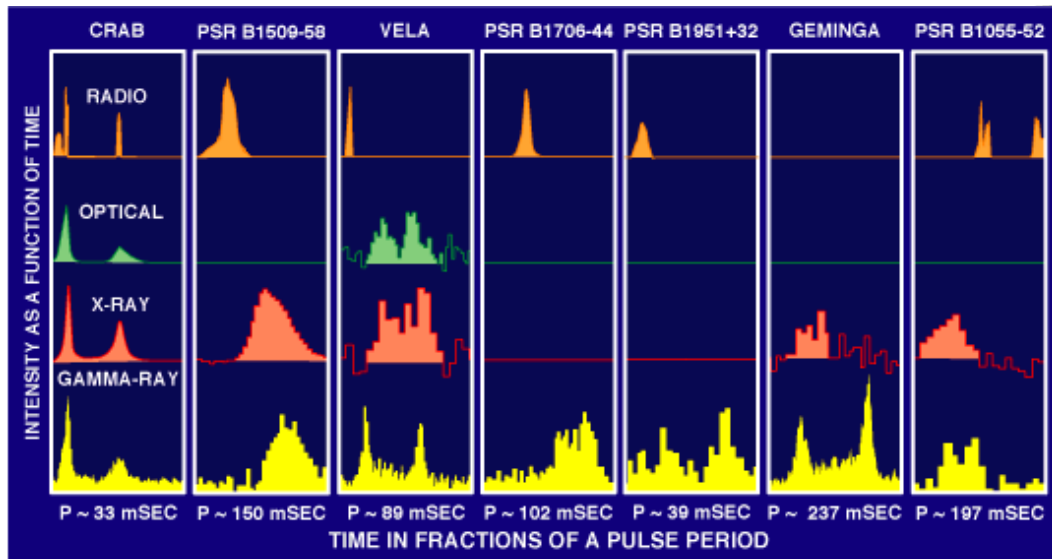
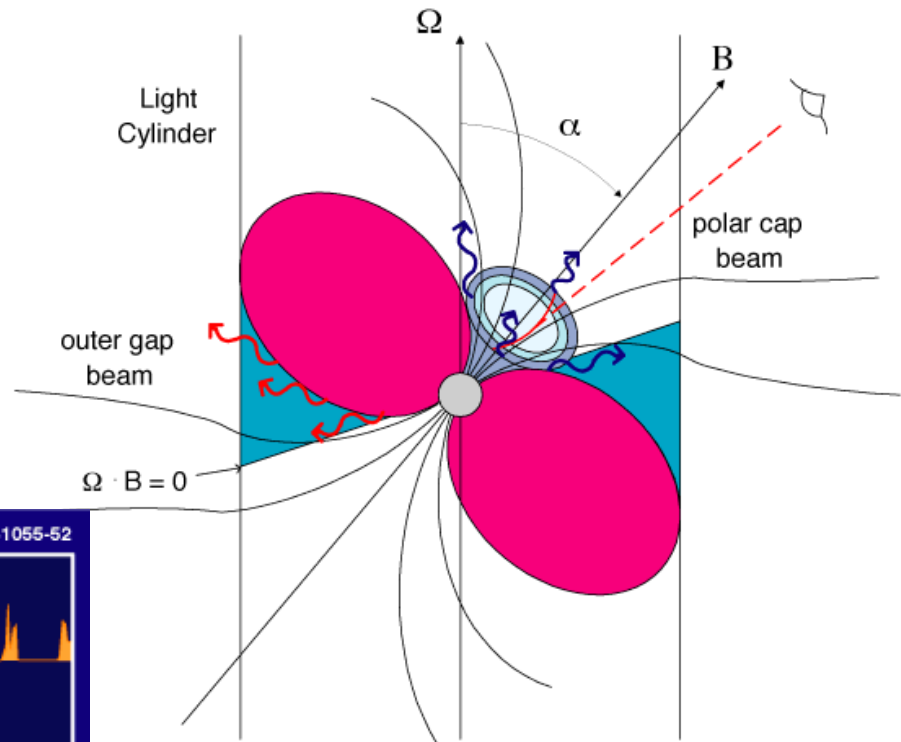
(Butt et al. 2002)

(Gehrels et al. 2000)

Supernova Remnants

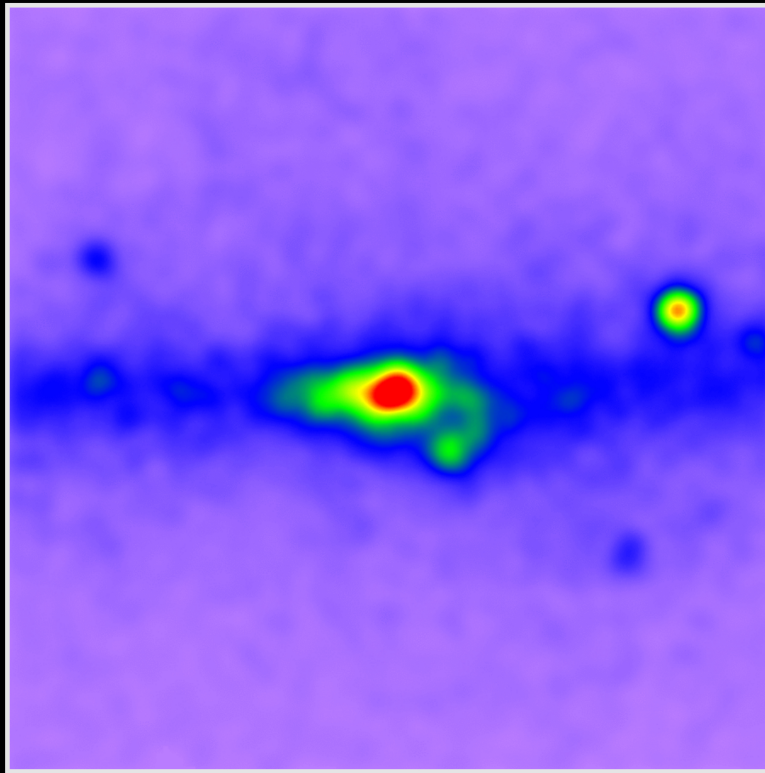


Pulsars

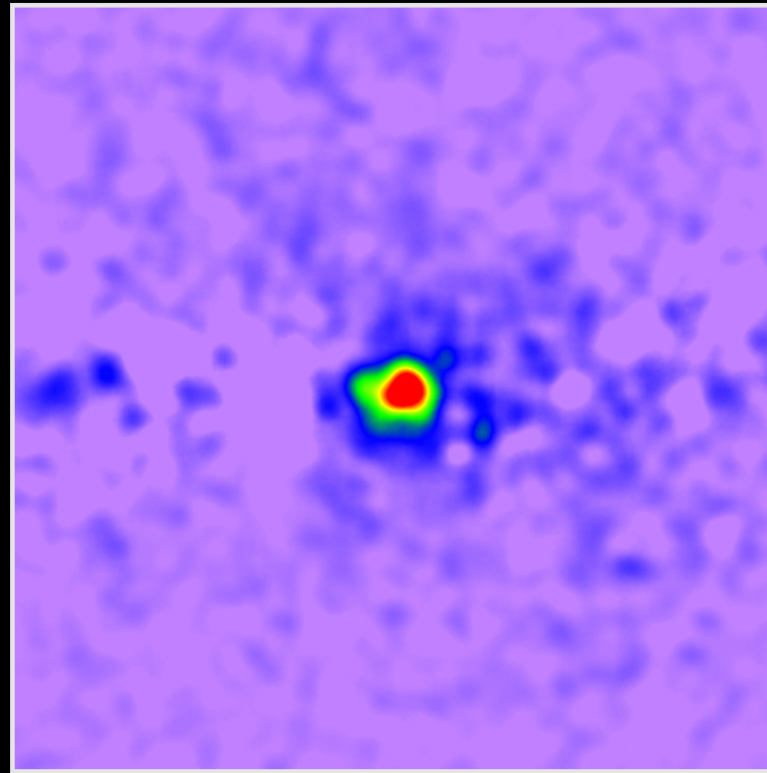


Dark Matter

Uncovering a gamma-ray excess at the galactic center

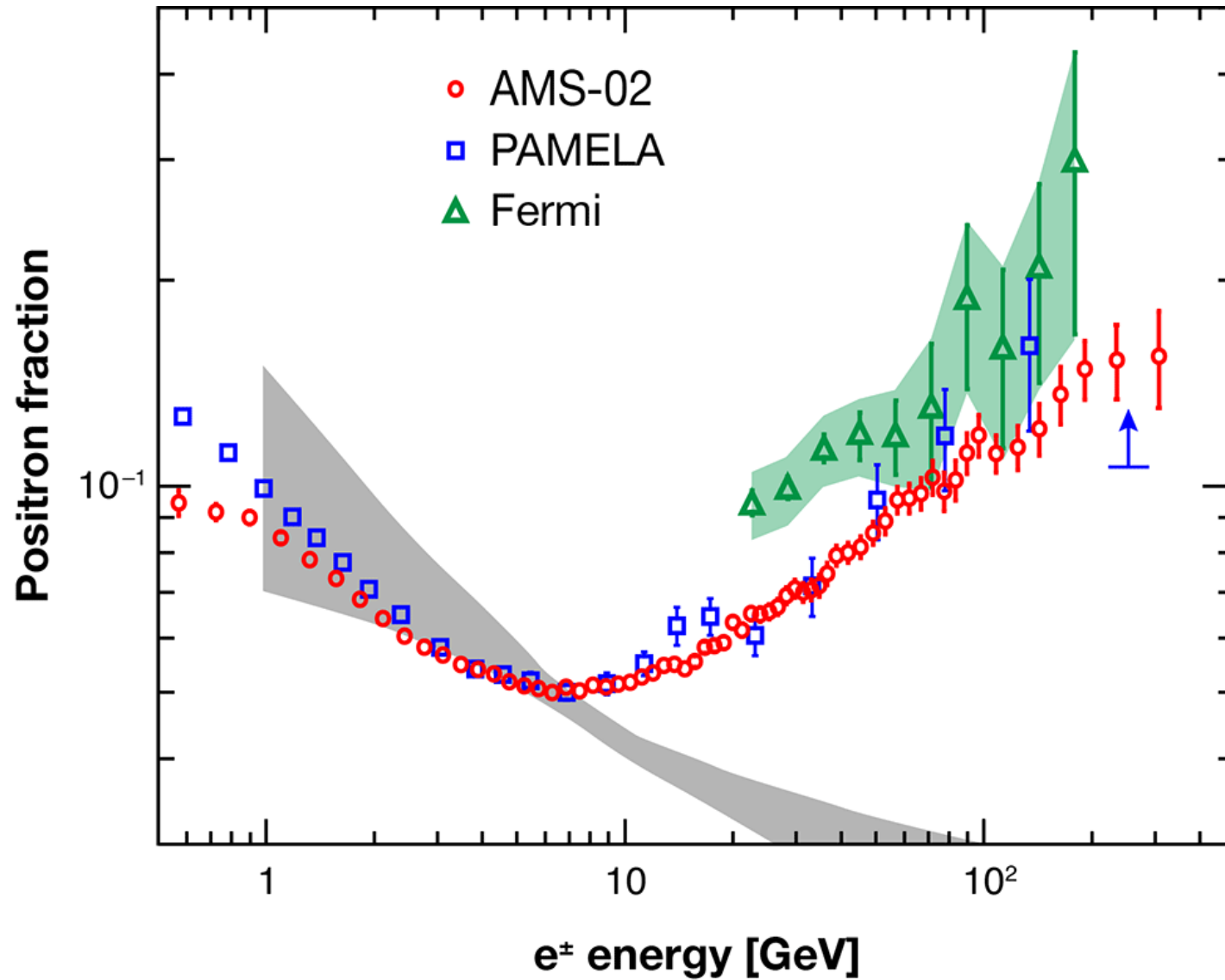


Unprocessed map of 1.0 to 3.16 GeV gamma rays



Known sources removed

AntiMatter



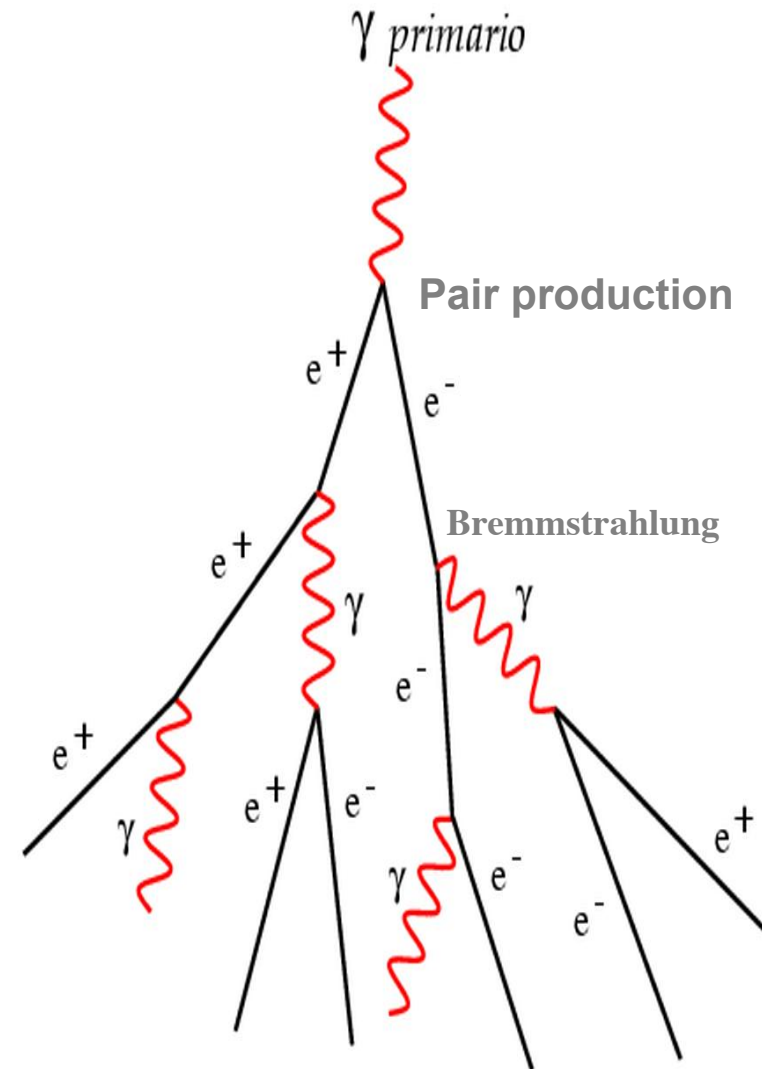
TeV astrophysics

Extensive Air Showers

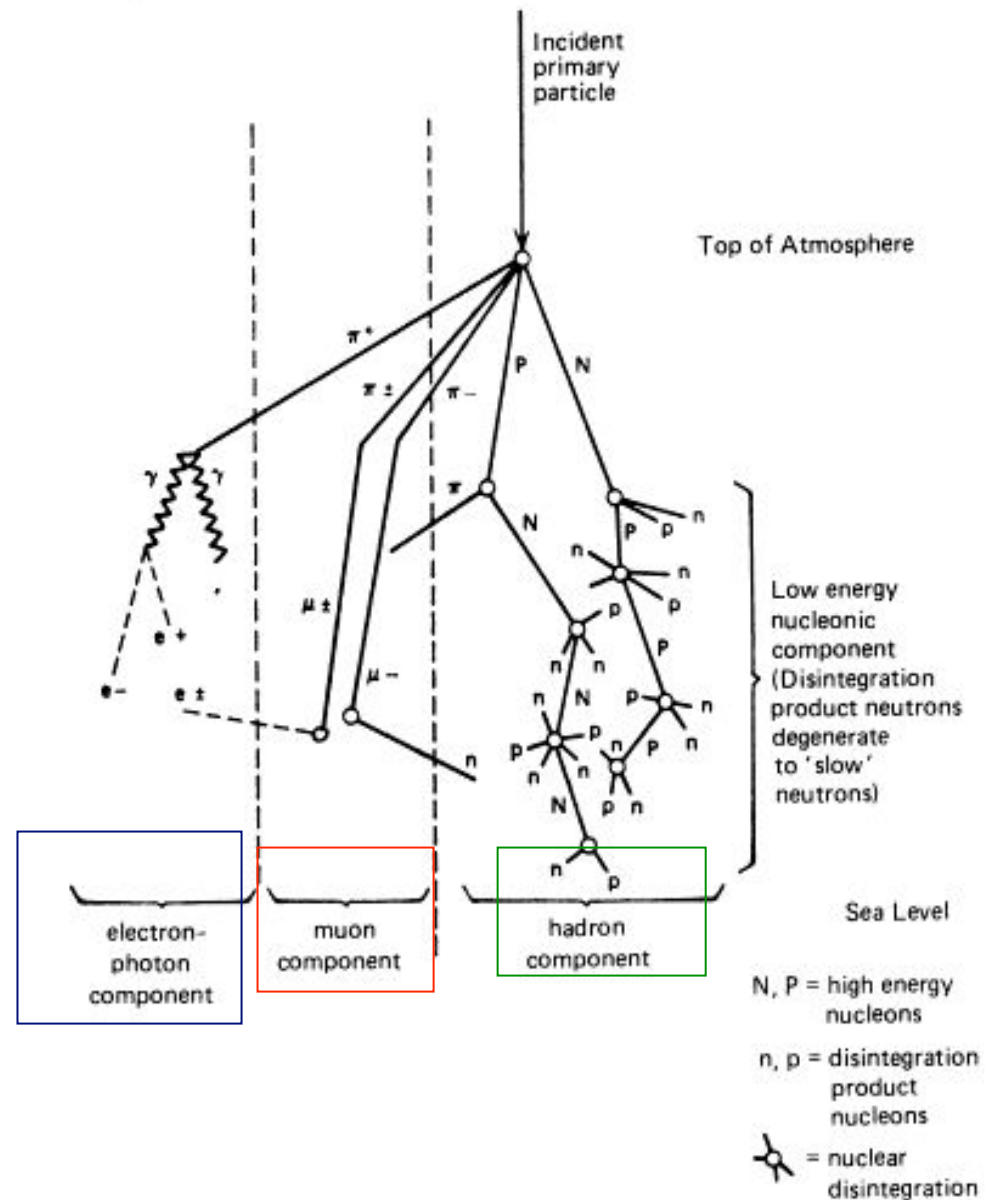
Gamma rays initiate showers of charged particles (mainly $e^\pm$) on entering the atmosphere

The air shower develops along the direction of the primary gamma

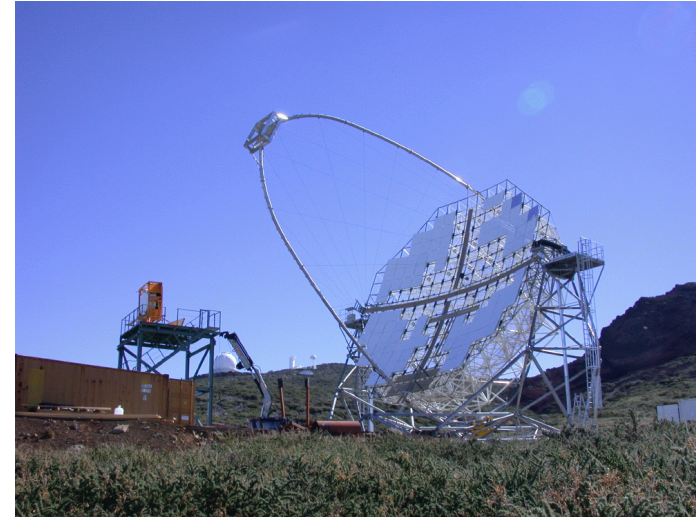
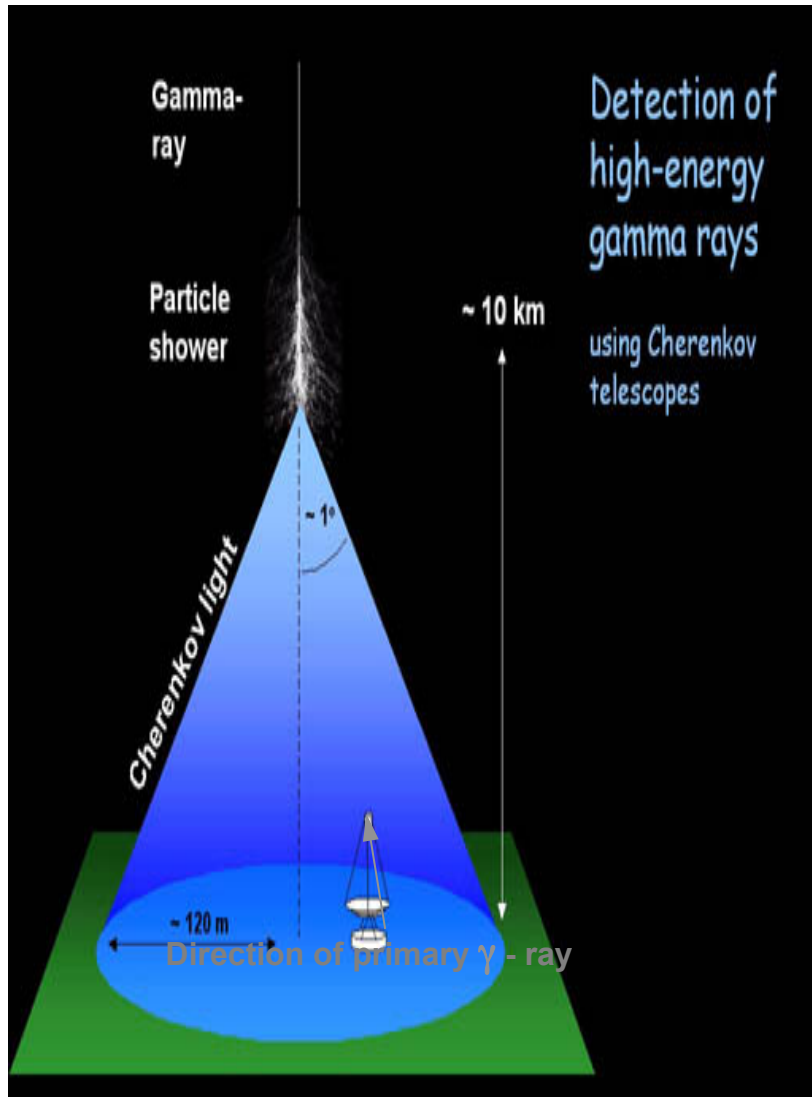
High energy $e^\pm$ with $v > c/n$ emit Cherenkov light which reaches ground level as a short flash (≈ 3 ns)



CR shower in the atmosphere



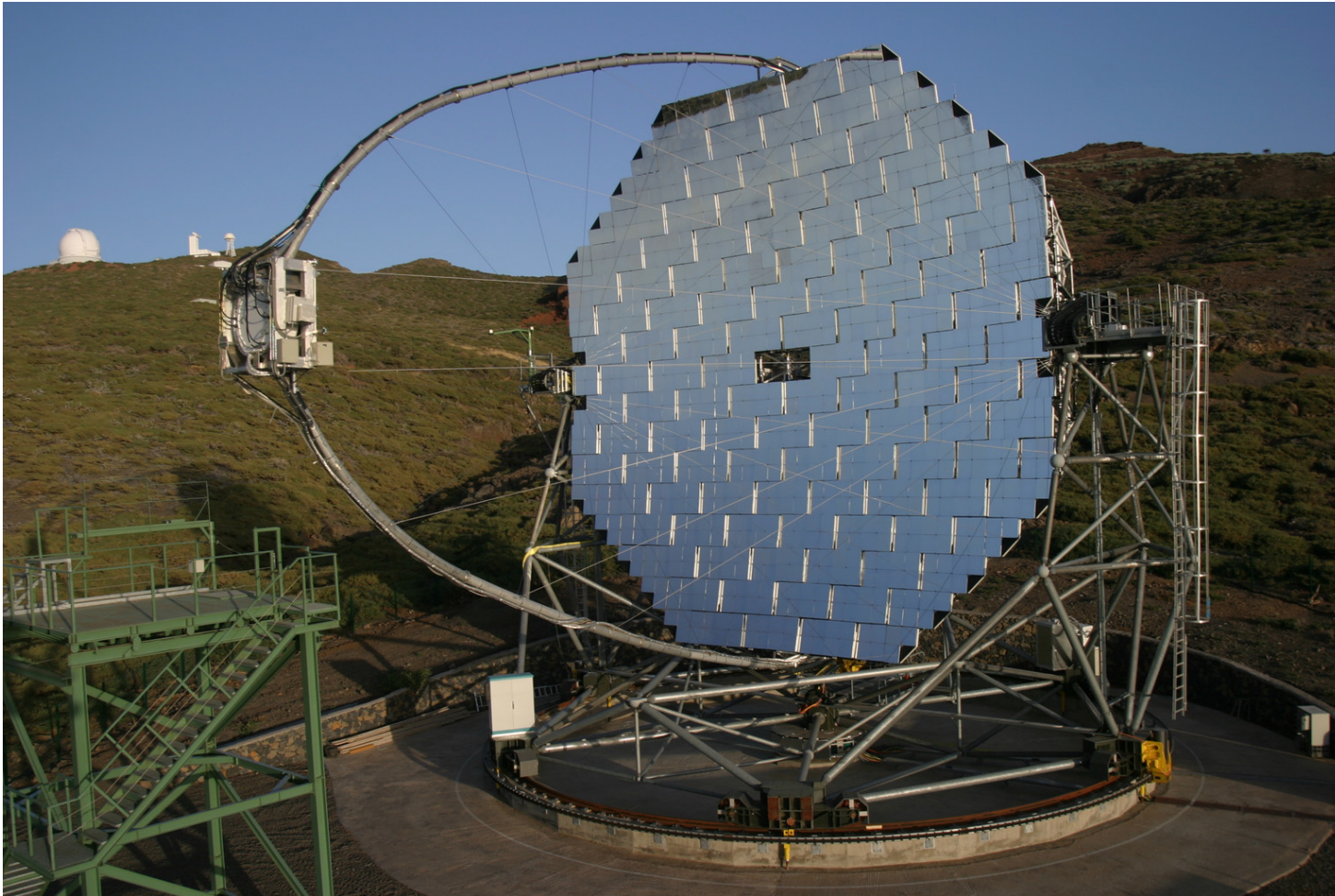
Imaging Atmospheric Cherenkov Telescopes



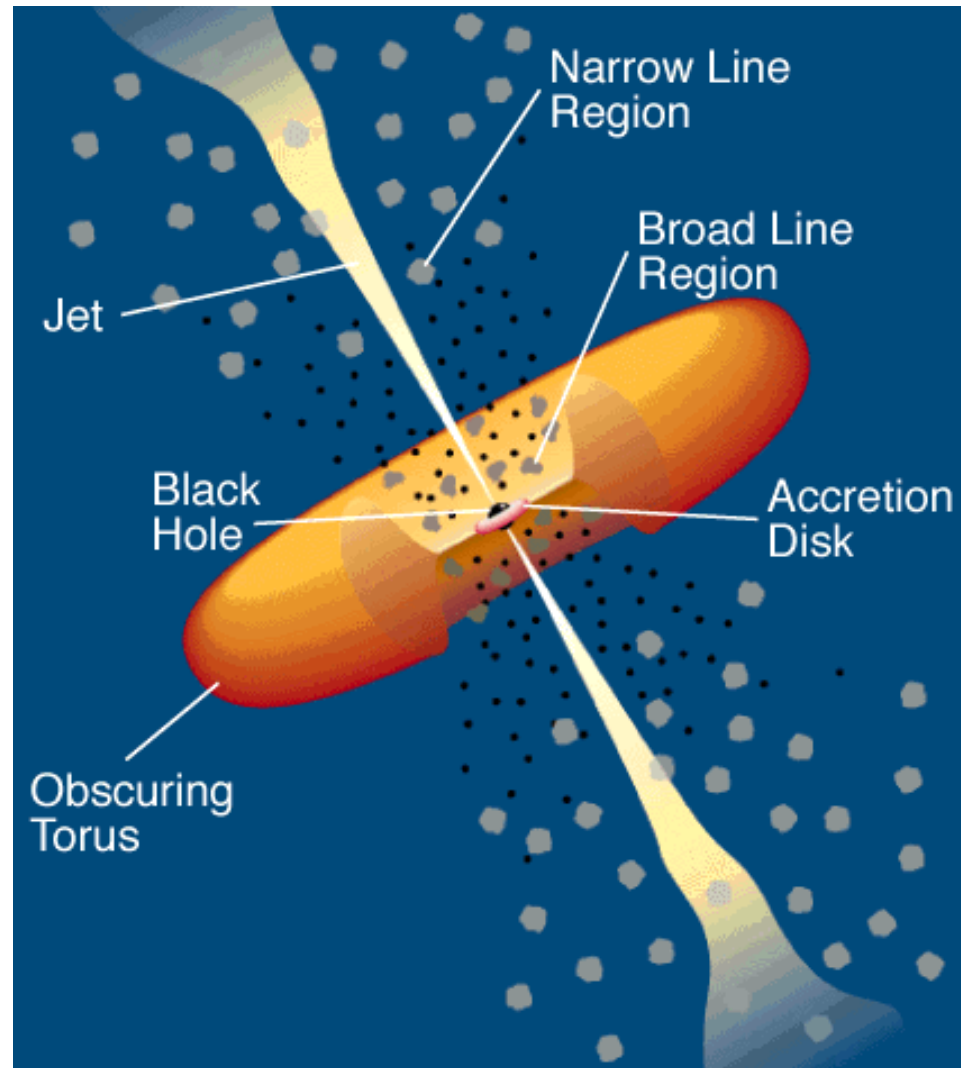
The principle:

A telescope placed inside the (huge) Cherenkov light pool can obtain an image of the development of the shower above the LONS fluctuations

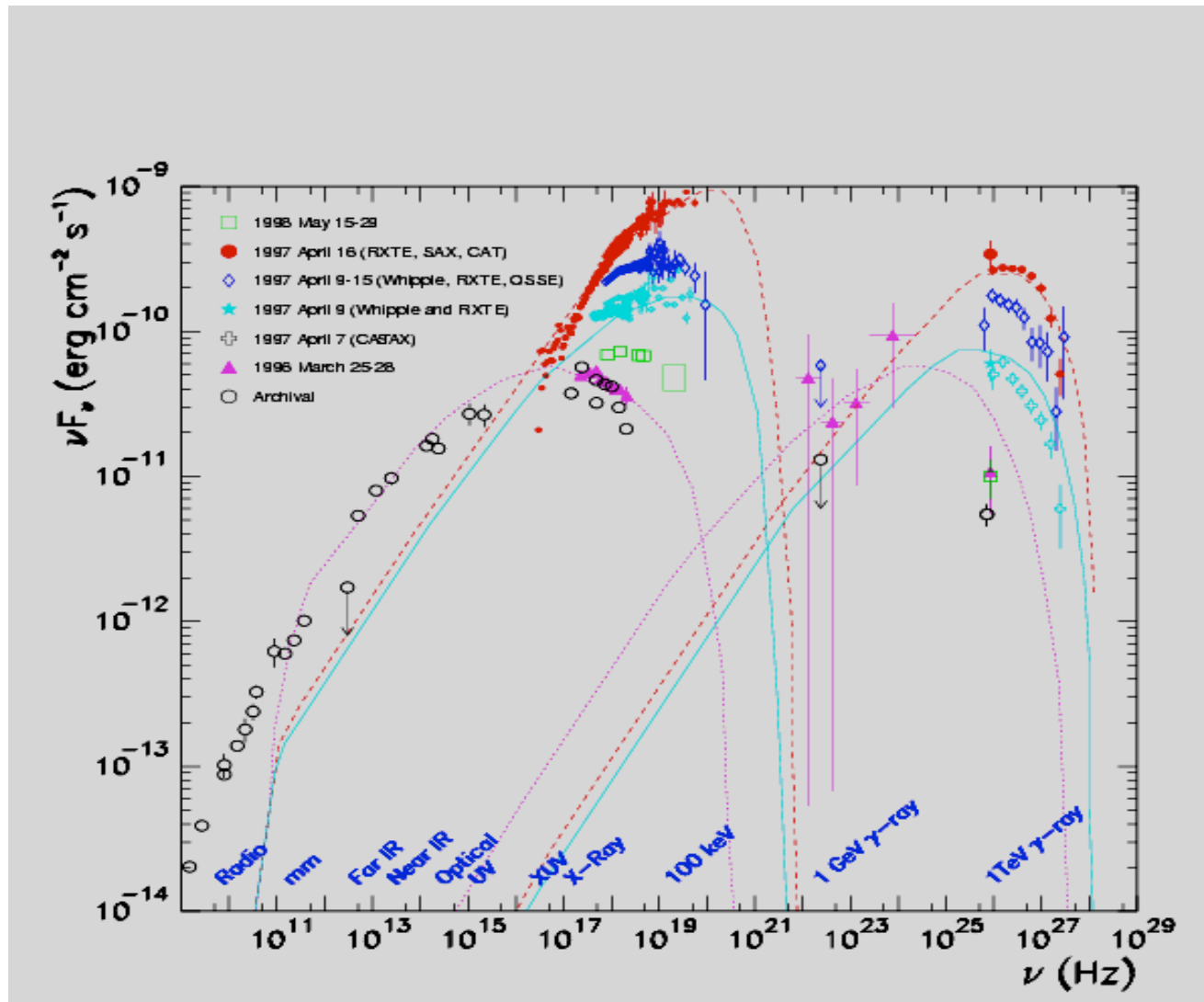
MAGIC



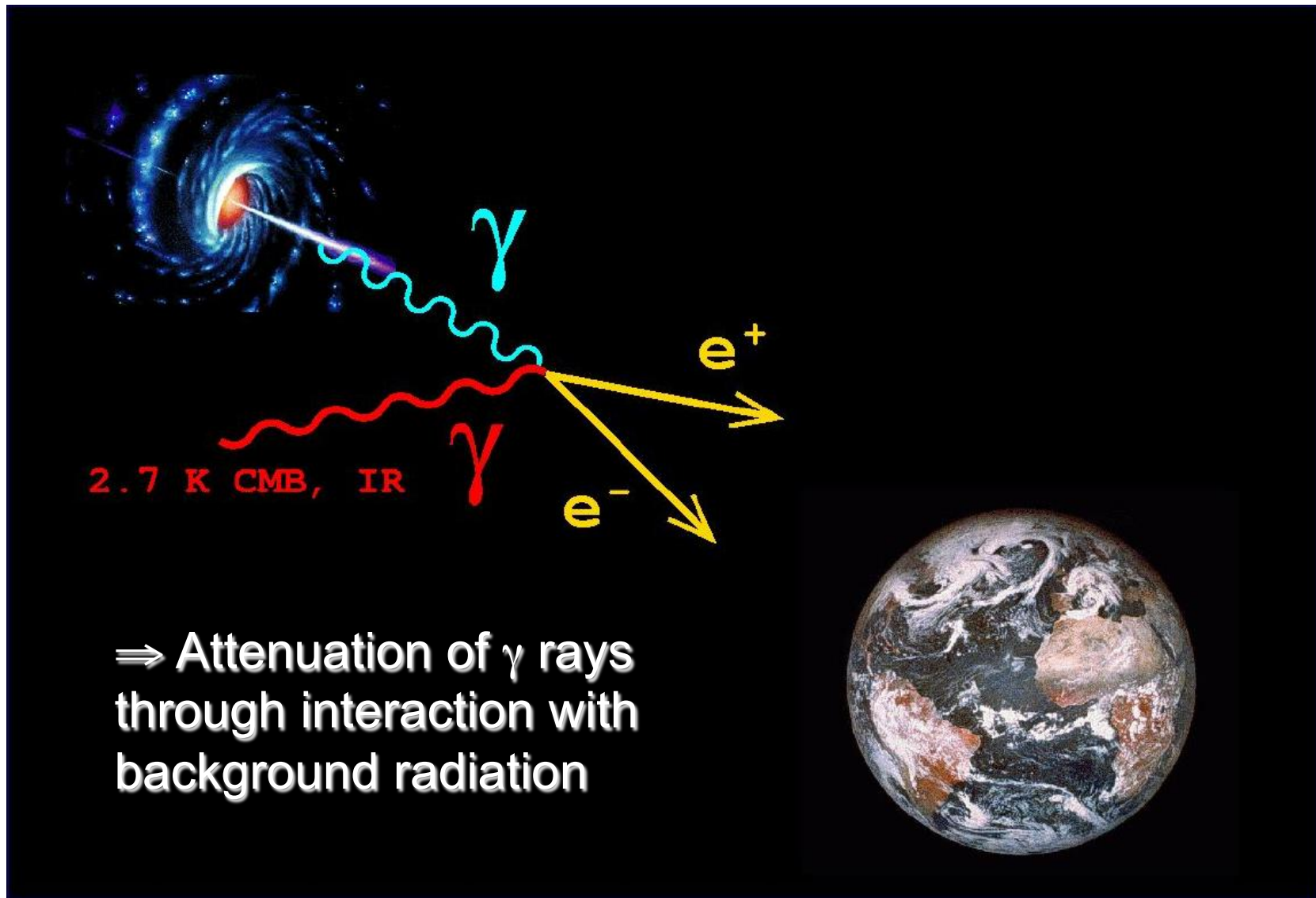
Active Galactic Nuclei



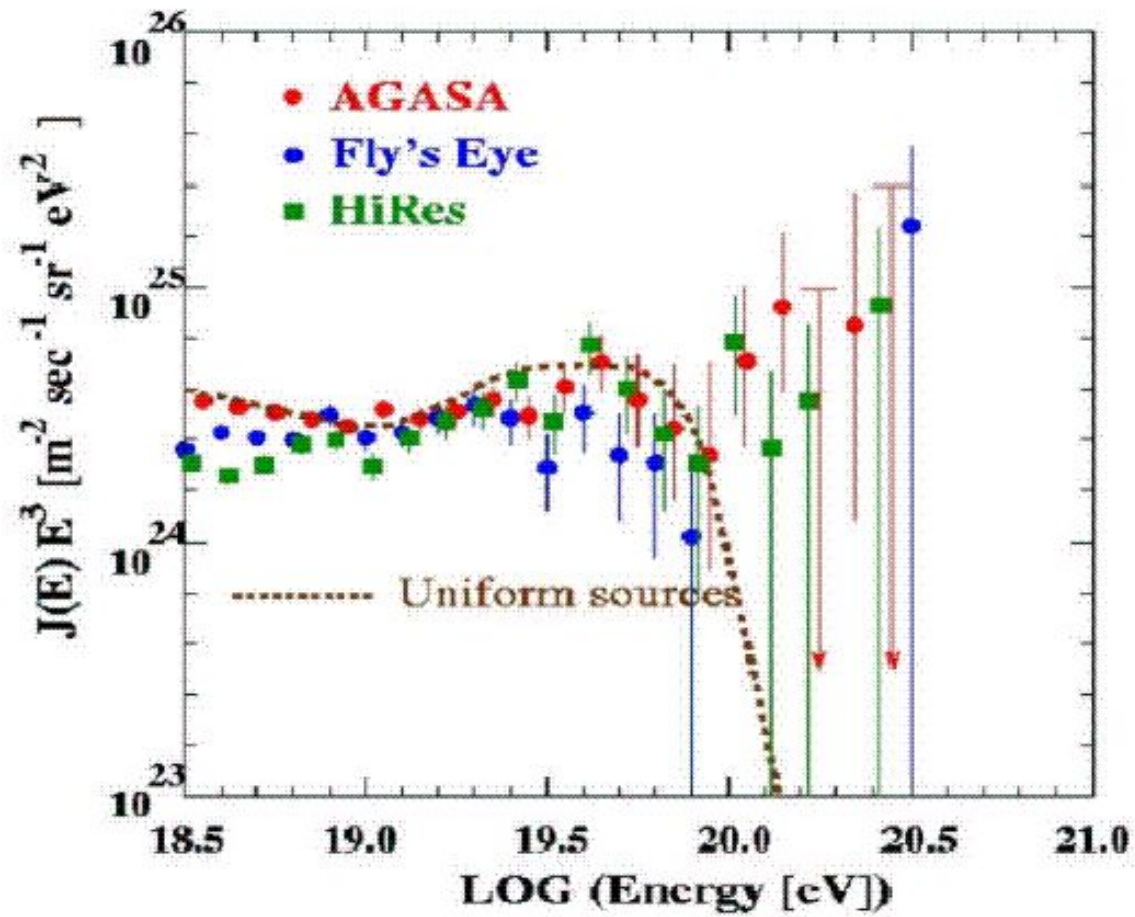
Active Galactic Nuclei



$$\gamma \gamma \longrightarrow e^+ e^-$$



UHECR physics



Conclusions

- Origin of CR: SNR?
- AGN: leptonic or hadronic jet model?
- Unidentified gamma sources: what are they?
- Gamma-ray Bursts: what powers them?
- The transparency of the Universe ...
- What the sources of HE neutrinos?
- What is the nature of DM?
- Are there EM counterparts of GW?

Astrofisica Nucleare e Subnucleare

Introduzione - 2

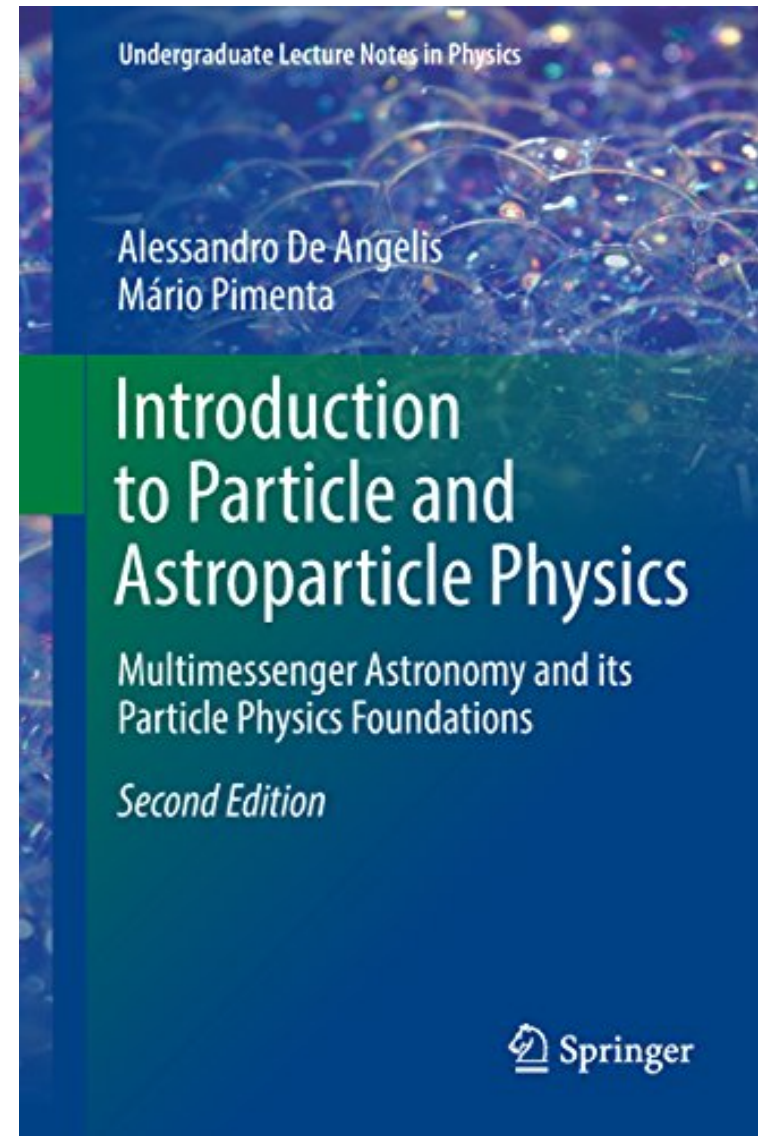
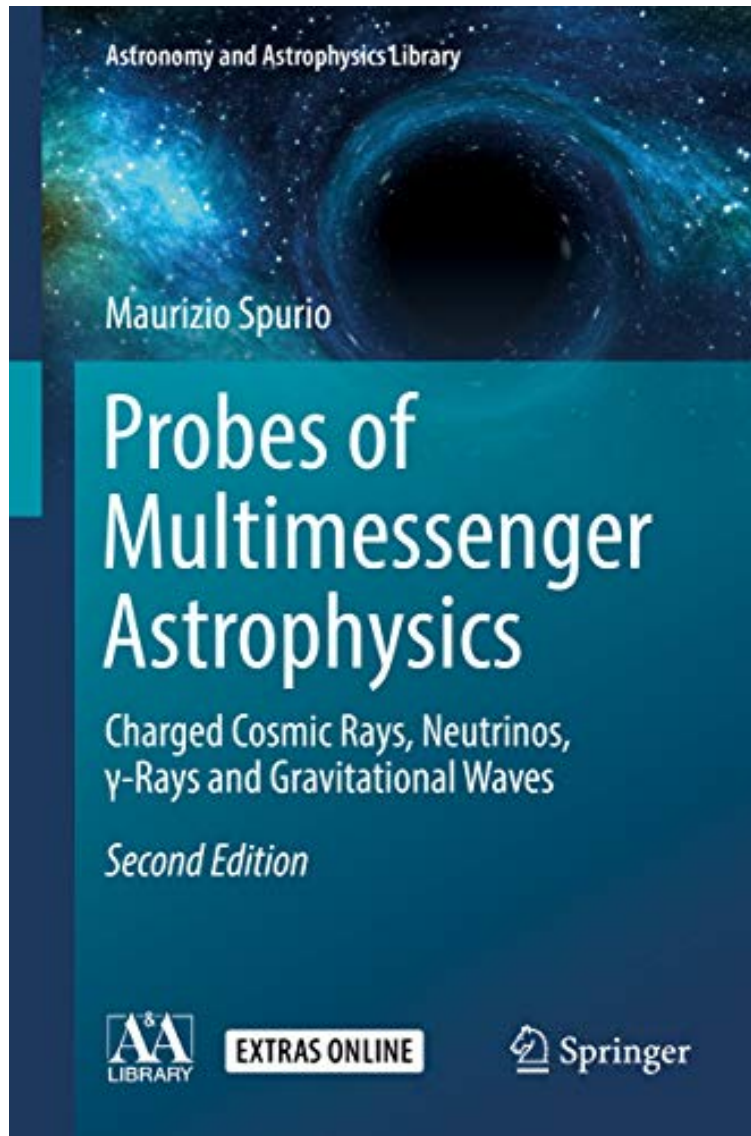
Organizzazione del corso

- Lezioni frontali
 - Introduzione agli argomenti di Astroparticelle e Astrofisica Nucleare
- Journal Club
 - Lettura di articoli di riferimento del settore
 - Discussione a lezione
- Seminari
 - Invito di esperti del settore (presso UniTs / INFN Ts / INAF Ts)

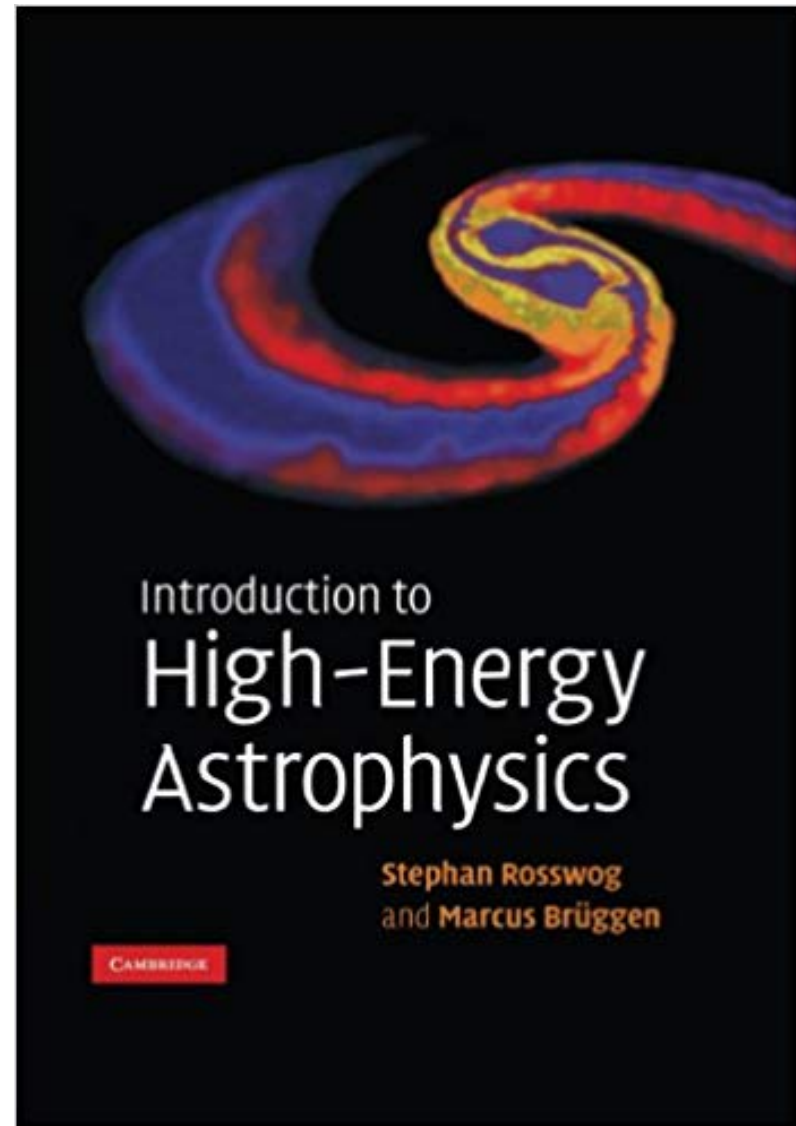
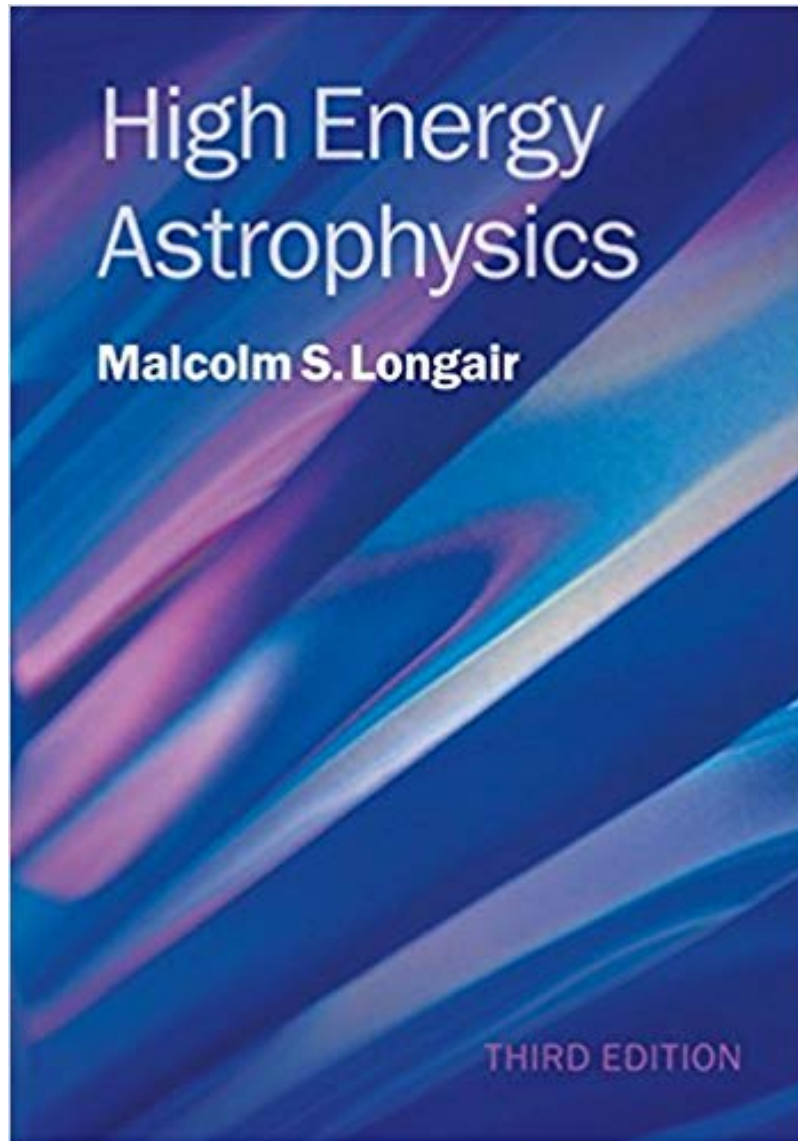
Data Analysis

- Gamma Ray data analysis
 - Analysis of MeV GRB data
 - Analysis of GeV Gamma ray data
 - Analysis of TeV Gamma ray simulated data
- Analysis of Multiwavelength data
 - Look for CR open data
- Simulations of Astroparticle experiments
 - G4 simulation toolkit introduction

Testi



Testi



Astrofisica Nucleare e Subnucleare

Introduzione - 3

L'INFN

La fisica delle Astroparticelle



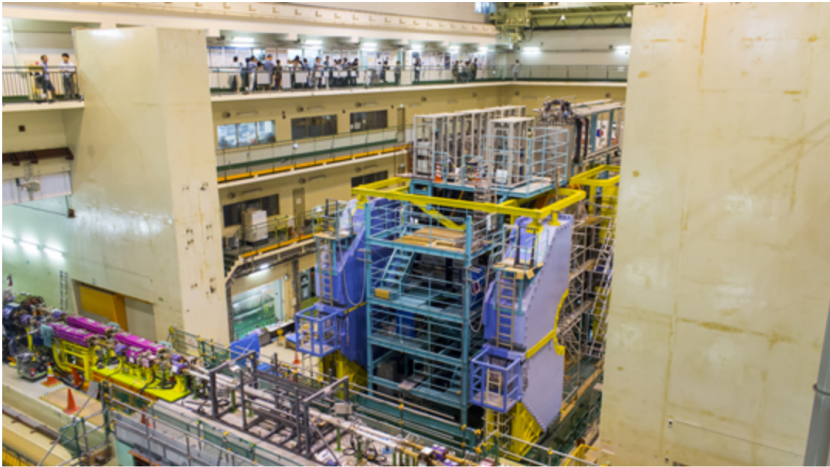
Istituto Nazionale di Fisica Nucleare

PORTALE INFN SERVIZI ELENCO TELEFONICO

Info Cerca...

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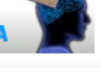


NEWS INFN 1 2 3 4 5

CIRCOLANO I PRIMI FASCI NELL'ACCELERATORE SUPERKEKB

Il 2 marzo 2016 per la prima volta sono stati iniettati e fatti circolare stabilmente dei fasci di particelle negli anelli dell'acceleratore SuperKEKB nel laboratorio KEK a Tsukuba, in Giappone. "È un traguardo importante nella messa a punto della macchina acceleratrice progettata per arrivare a una luminosità mai raggiunta finora, ben quaranta volte più alta..."
[Read more](#)

LINEE DI RICERCA

- 1 fisica delle **PARTICELLE** 
- 2 fisica delle **ASTROPARTICELLE** 
- 3 fisica **NUCLEARE** 
- 4 fisica **TEORICA** 
- 5 ricerca **TECNOLOGICA** 

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I laboratori dell'INFN

Laboratori Nazionali di Frascati

HOME CHI SIAMO RICERCHE ACCELERATORI NOVITÀ EDUCATIONAL LNF USERS



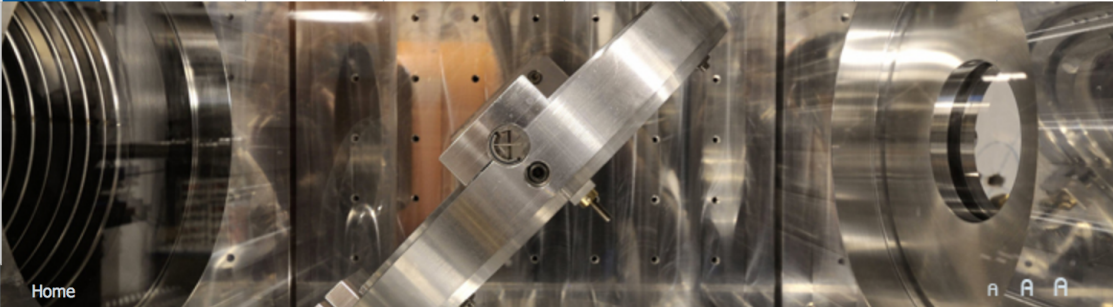
cerca...

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Scelti per voi

- [Miriam Mafai racconta Bruno Pontecorvo](#)



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Benvenuti ai Laboratori Nazionali di Frascati

I Laboratori Nazionali di Frascati (LNF) sono la più antica struttura di ricerca per la fisica nucleare e subnucleare italiana con macchine acceleratrici e il più grande Laboratorio dell'Istituto Nazionale di Fisica Nucleare (INFN), l'Ente che promuove, coordina e finanzia la ricerca nel campo della fisica subnucleare e nucleare.

[LEGGI TUTTO...](#)

Un magnete dal CERN per la ricerca dei dark photon a Frascati  



L'INFN ha recentemente approvato un esperimento per la ricerca di una nuova interazione fondamentale in grado di collegare il nostro mondo con la materia oscura, di cui in gran parte è composto l'Universo, ma di cui ignoriamo la natura. L'esperimento PADME è infatti un apparato sperimentale dedicato alla ricerca del mediatore della nuova "forza oscura" ("fotone oscuro" o "dark photon"), simile al fotone dell'ordinaria radiazione elettromagnetica, ma dotato di una piccola massa e molto debolmente interagente con la materia ordinaria.

[LEGGI TUTTO...](#)

Contatti

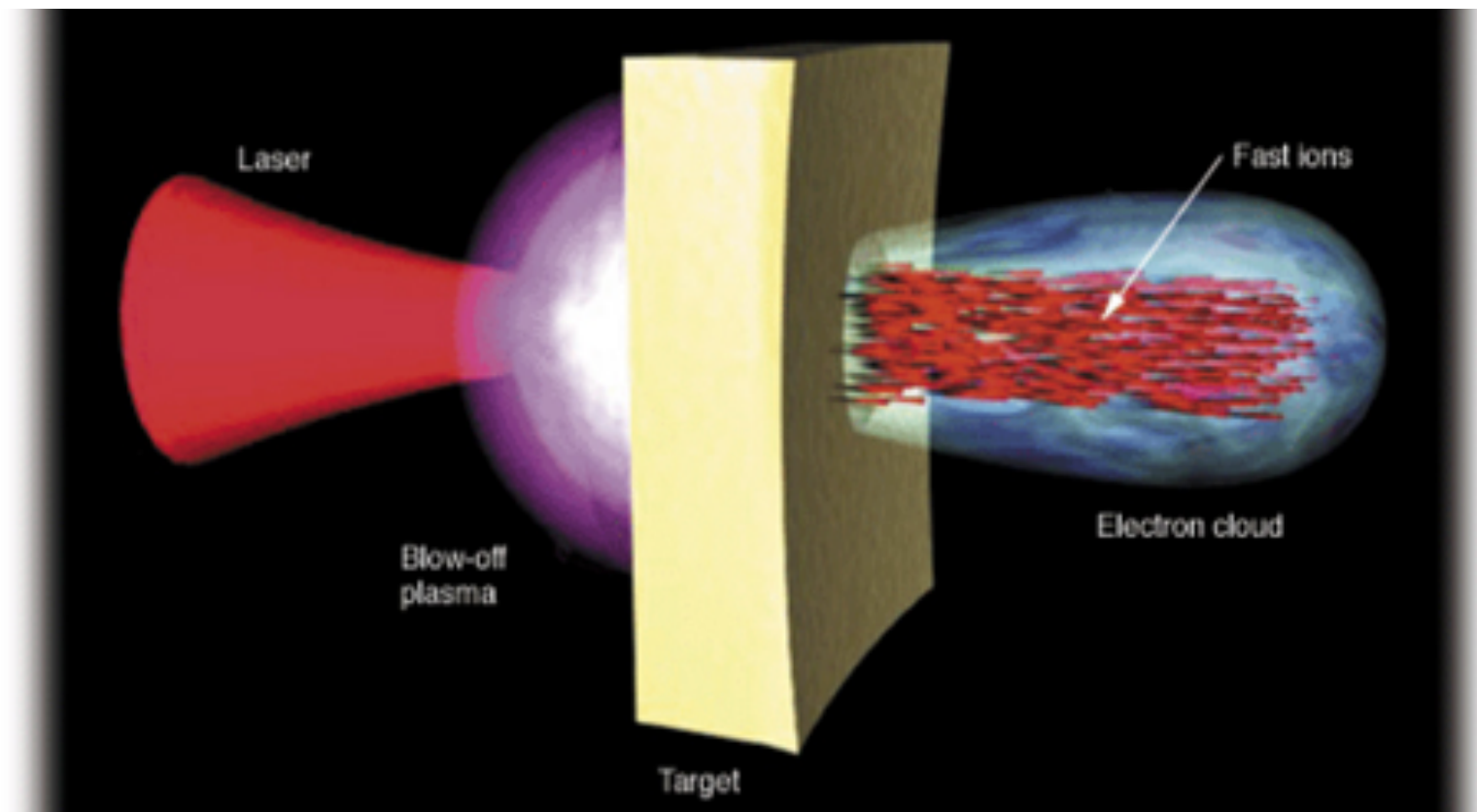
INFN - LNF

Via E. Fermi, 40
00044 Frascati (Roma) Italy
Tel +39 06 94031
Fax +39 06 9403 2582

Direzione
Direttore: Dr. Pierluigi Campana
Tel. +39 06 94031
e-mail: dirlnf@lnf.infn.it
Lab.Naz.Frascati@pec.infn.it

www.lnf.infn.it

Nuovi meccanismi di accelerazione



I laboratori dell'INFN



Laboratori Nazionali del Gran Sasso

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Un detective hi-tech
si è messo sulle
tracce della materia
oscura

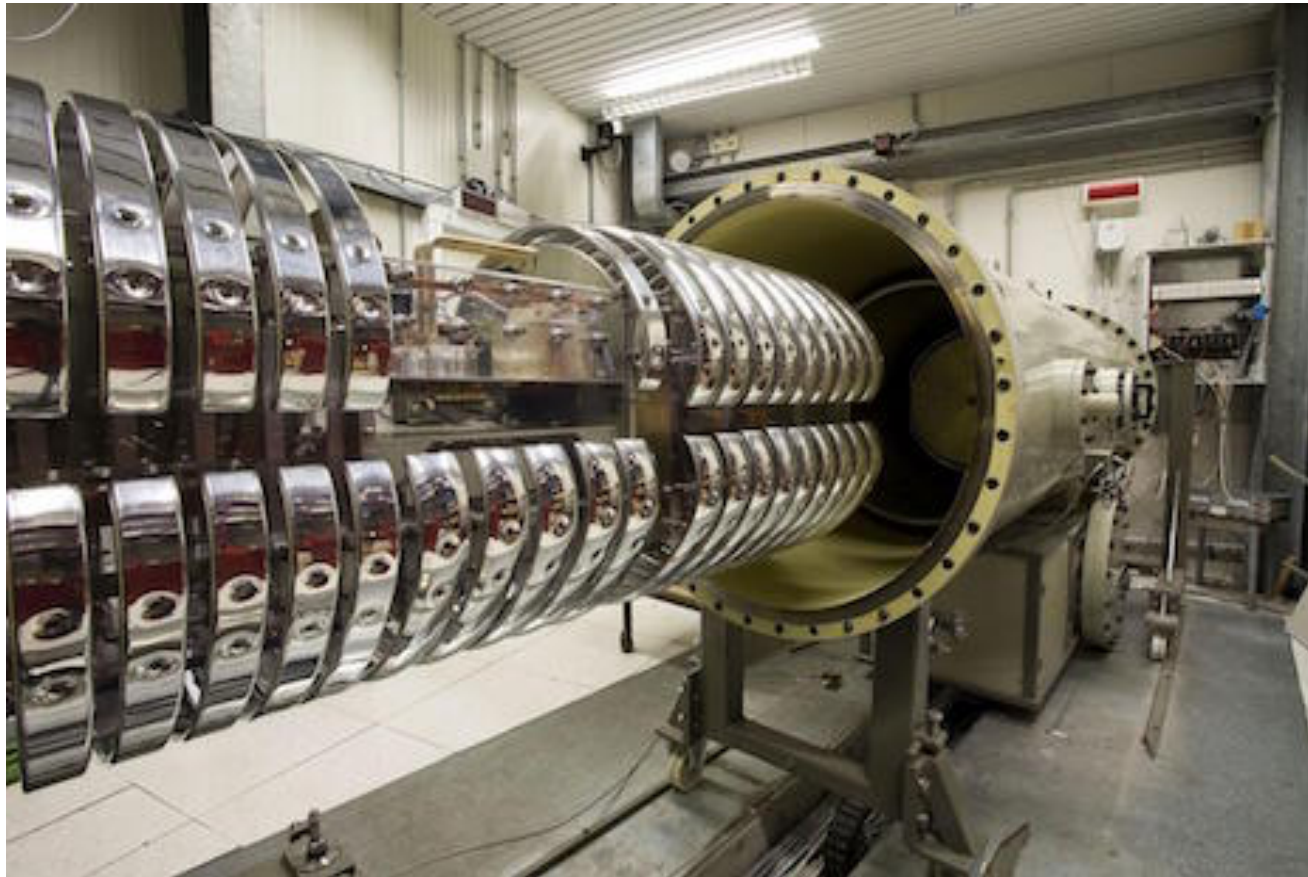
Inaugurato ai Laboratori INFN del Gran
Sasso l'esperimento DarkSide-50 [Read
More](#)

www.lngs.infn.it

I laboratori del Gran Sasso



I meccanismi delle Stelle



L'esperimento LUNA

La Materia Oscura



L'esperimento DAMA

I neutrini?



L'esperimento Opera

I laboratori Nazionali del Sud



Istituto Nazionale di Fisica Nucleare

Laboratori Nazionali del Sud



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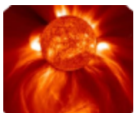
Announcements

Pubblicati i risultati di una interessante ricerca sui capodogli, in transito nello Jonio, grazie all'ascolto dei loro suoni. Info sulla rivista [Plos one](#).

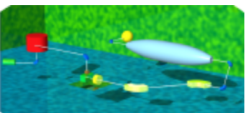
Upcoming Events

- Tue 26-Apr-2016 Joint LIA COLL--AGAIN
- Wed 7-Sep-2016 III ELIMED Workshop

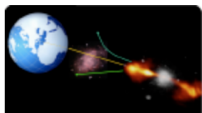
LNS activity overview



Nuclear Physics



Accelerators



Astroparticle Physics



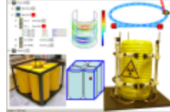
Detector systems



Ion Sources



Theory



INFN-Energy



Protontherapy



Multidisciplinary facilities



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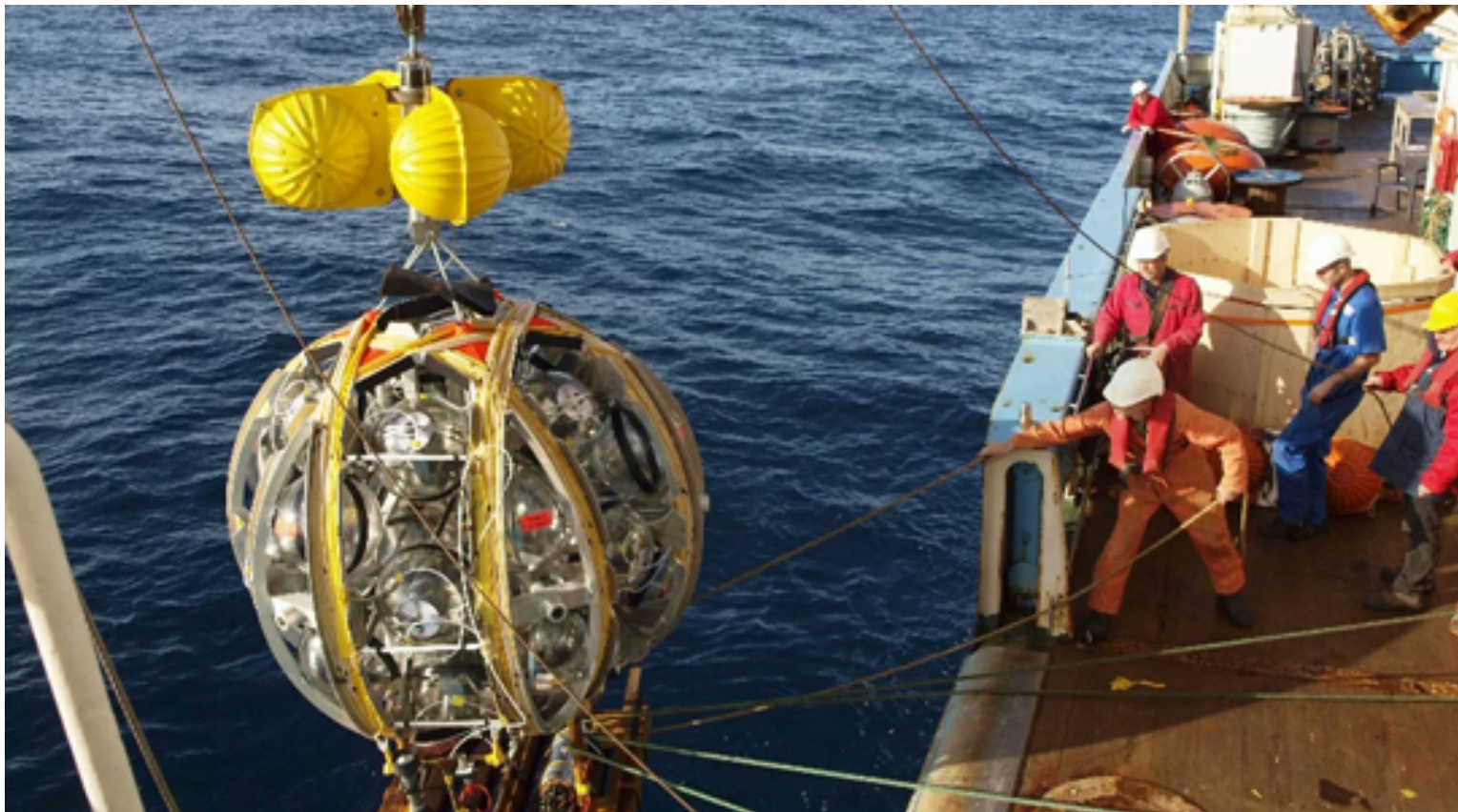
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Administration
Fattura elettronica (e-Invoice)
Secretariat
Meeting rooms (internal)

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I neutrini astrofisici



I neutrini astrofisici



I laboratori Nazionali di Legnaro



Laboratori Nazionali di Legnaro

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- Lavorare ai LNL
- Eventi speciali
- L'ambiente



LNL Seminars

Managing a high intensity high energy cyclotron for medical applications

Dr. Ferid Haddad and Dr. Nicolas Varmerot (GIP Arronax, France)

Thursday, 21 January 2016 from 15:00 to 16:00 C. Villi meeting room

Sviluppo e caratterizzazione della sorgente di ionizzazione al plasma del progetto SPES

Dr. Fabio Visentin

Friday, 22 January 2016 from 14:15 to 15:15 Rostagni meeting room

Archiver Appliance to EPICS control systems

Dr. Thomas Birke (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH)

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Benvenuti ai Laboratori Nazionali di Legnaro (LNL)



I LNL sono uno dei quattro laboratori nazionali dell'Istituto Nazionale di Fisica Nucleare (INFN). La missione principale dei LNL riguarda la ricerca di base nella fisica e astrofisica nucleare assieme alle applicazioni di tecnologie nucleari.

Più di 800 ricercatori da ogni parte del mondo partecipano ai programmi di ricerca in corso. Ai LNL prestano servizio 250 persone, metà di quali sono dipendenti dell' INFN (fisici, ingegneri, tecnici ...), la restante parte proviene da università e centri di ricerca nazionali o stranieri. Il bilancio dei LNL si aggira sui 20 milioni di Euro all'anno, di cui metà dedicata alle spese di gestione e ricerca, l'altra metà al personale. Punti di forza dei laboratori sono la realizzazione di acceleratori di particelle nucleari e lo sviluppo di rivelatori di radiazioni nucleari.

LNL Events

Intense and Powerful Accelerator Beams for industrial and energy application (IPAB2016)

14 - 15 March 2016, INFN-LNL

[All events](#)

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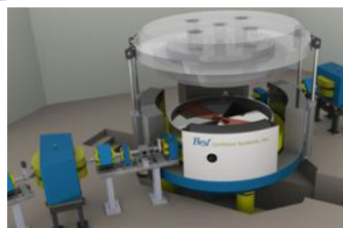
Le onde gravitazionali



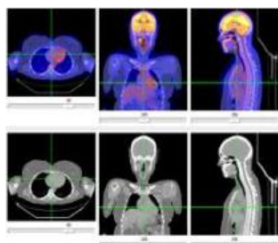
Il progetto SPES



Le quattro fasi del progetto SPES



**Ciclotrone e
infrastruttura**



**Radioisotopi per
la salute**



**Facility per fasci
di ioni radioattivi**



**Sorgenti di
neutroni basate
su acceleratori**