High Energy Astrophysics and Blue Water Cruising

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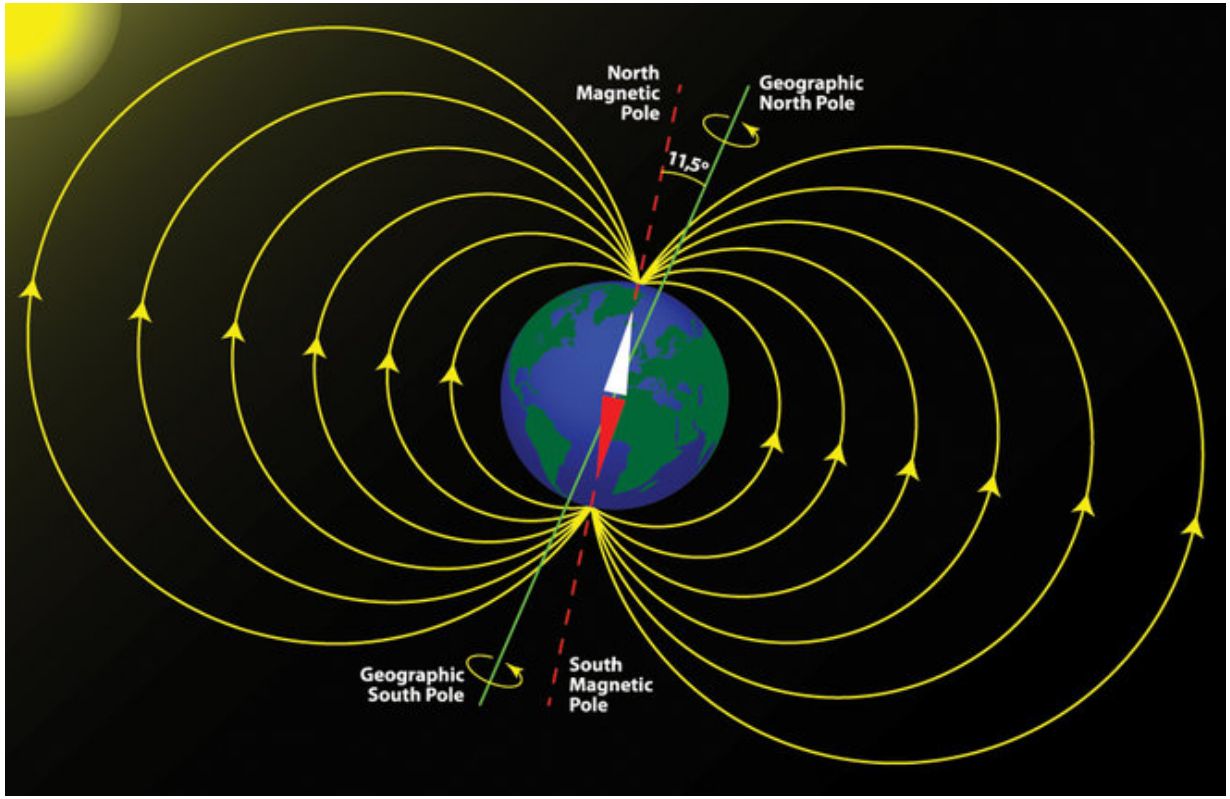
May 22 2018

Measure of cosmic rays at high latitude



Particles follow magnetic field lines at low energies

Lorentz force

$\underline{F}_L = e\,(\underline{E} + \underline{v} \times \underline{B})$

Problems with compass at high latitudes, field lines have a large angle to the sea surface.

Synhrotron radiation:

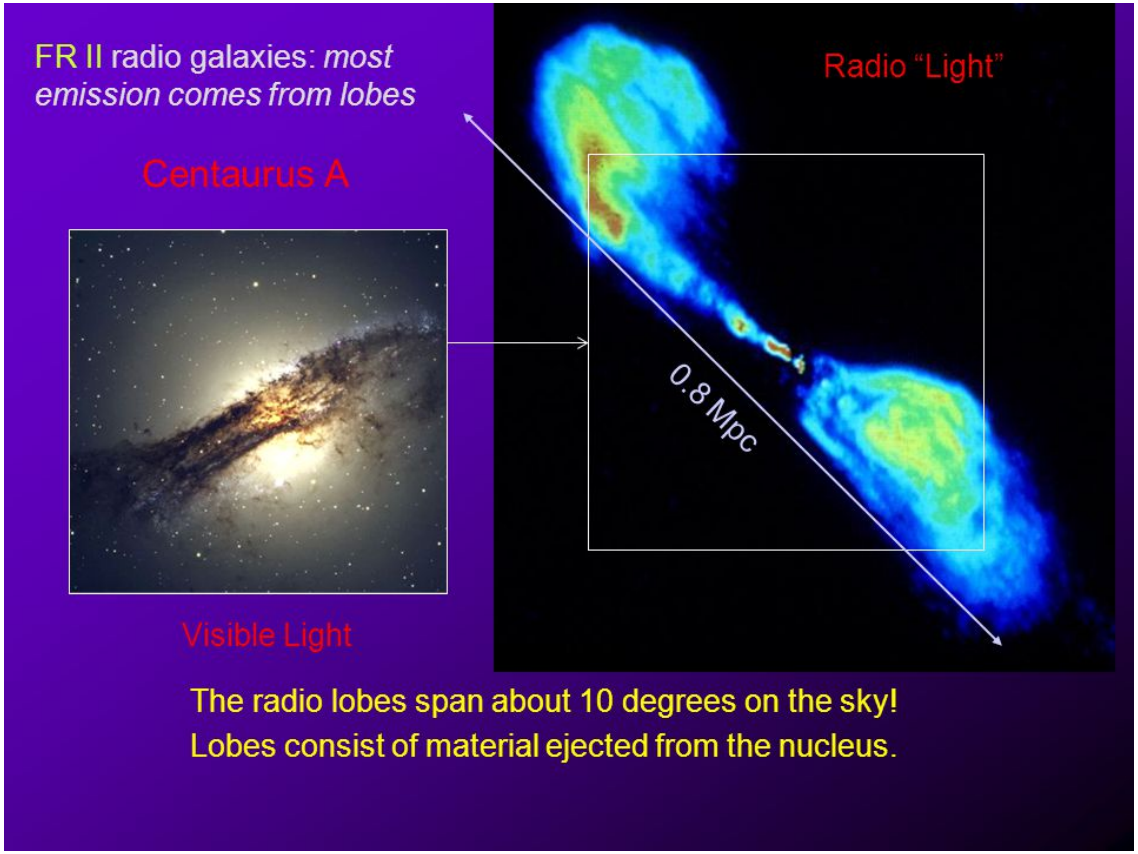
Accelerated charge radiates $\left|\frac{dE}{dt}\right| = \frac{c}{4\pi}\frac{|\ddot{p}|^2}{c^4}\int_0^\pi 2\pi \sin^3\theta \, d\theta = \frac{2}{3}\frac{|\ddot{p}|^2}{c^3}$

$\underline{p}=e\underline{x}$,

acceleration : Lorentz force $\underline{F}_L = e\,(\underline{E} + \underline{v} \times \underline{B})$

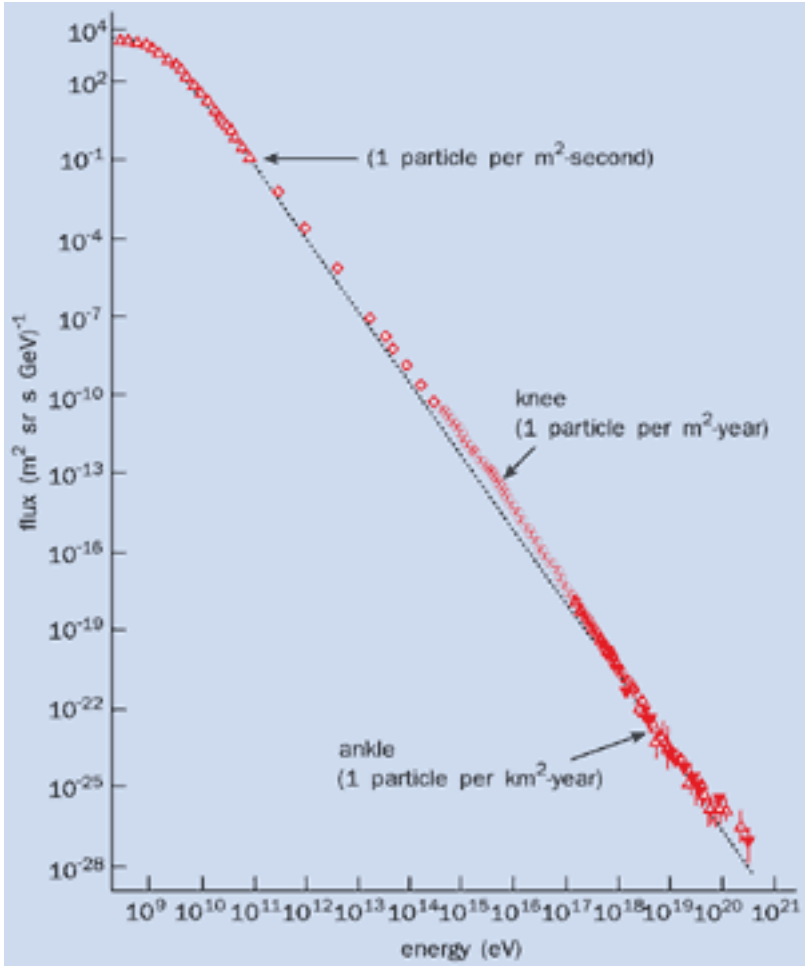
➔ charged particles in magnetic field radiate,

They can be observed, *and CERN spends a lot on electricity*.



V.Hess
1912

Cosmic rays originate somewhere...



Ingredients for particle acceleration:

E-field, seldom
F = e E, condensator

B-fields and shocks.
~similar to ping pong, racket is the B-field.

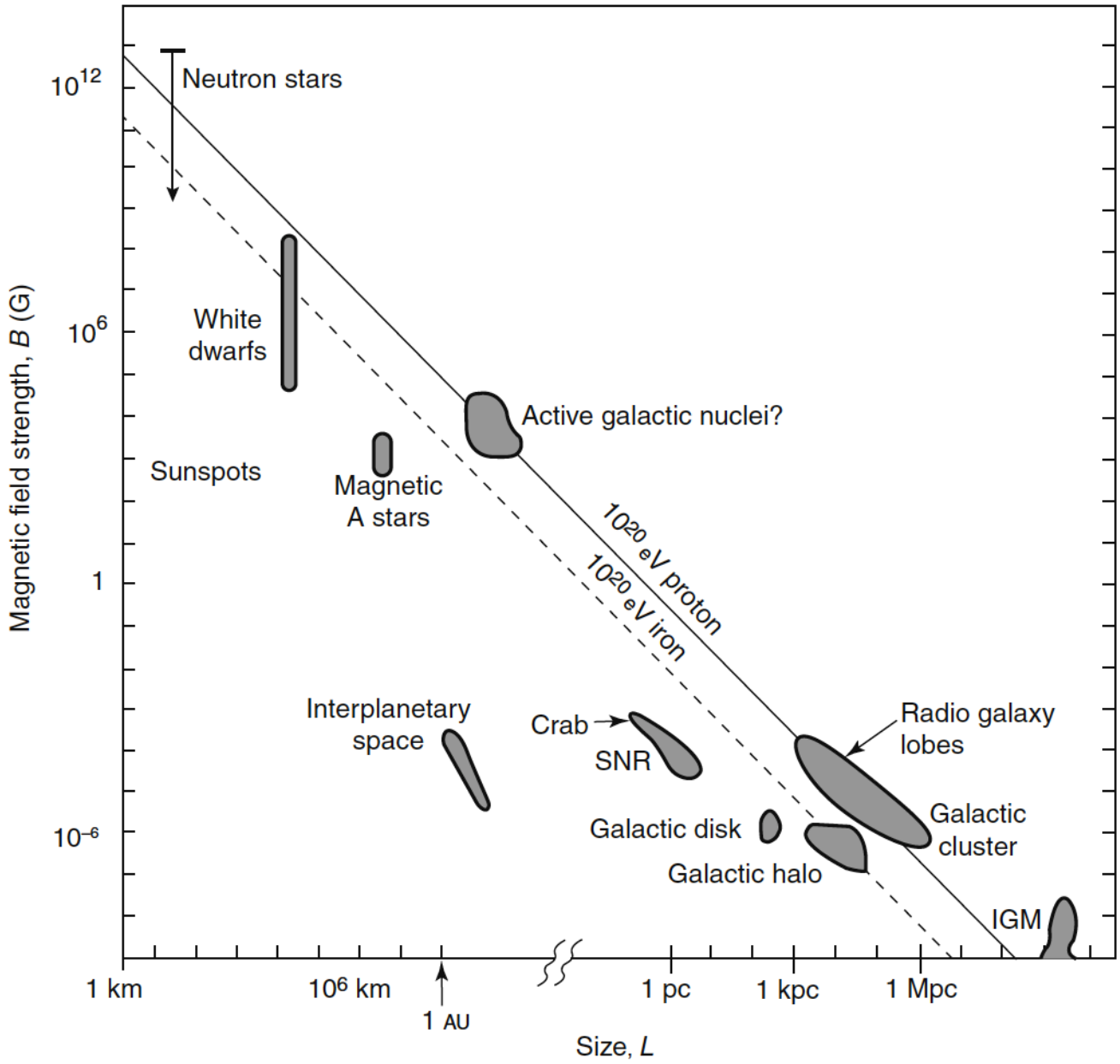


Fig. 9.5 Diagram illustrating the size and magnetic fields required for a region to accelerate magnetically-confined particles from the the review by Bauleo and Martino (2009), Fig. 4. Reprinted by permission of Nature Publishing Group

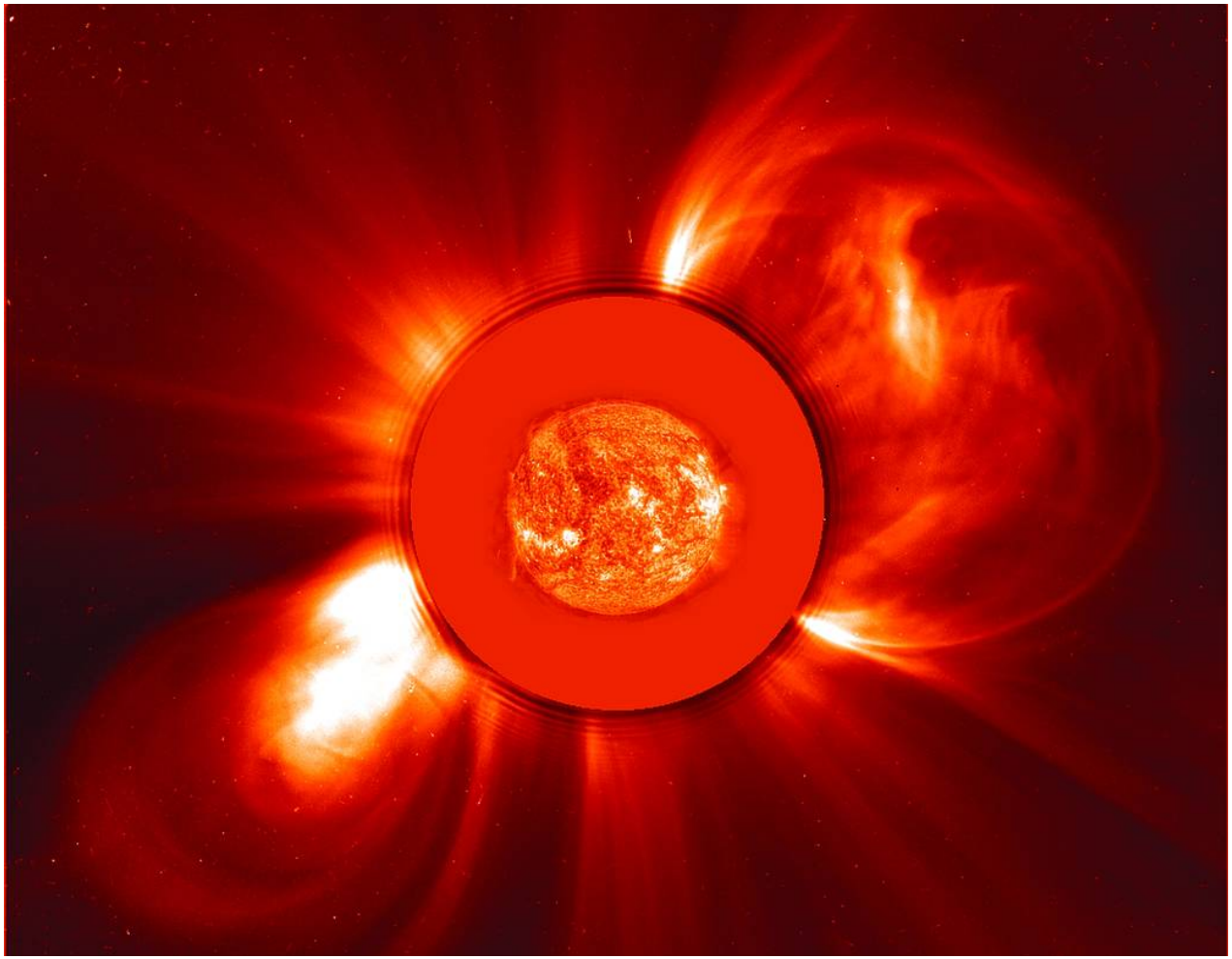
At low energy the solar and Earth magnetic fields play a role.

There is a modulation with the solar cycle: more particles at low solar activity (B weaker).

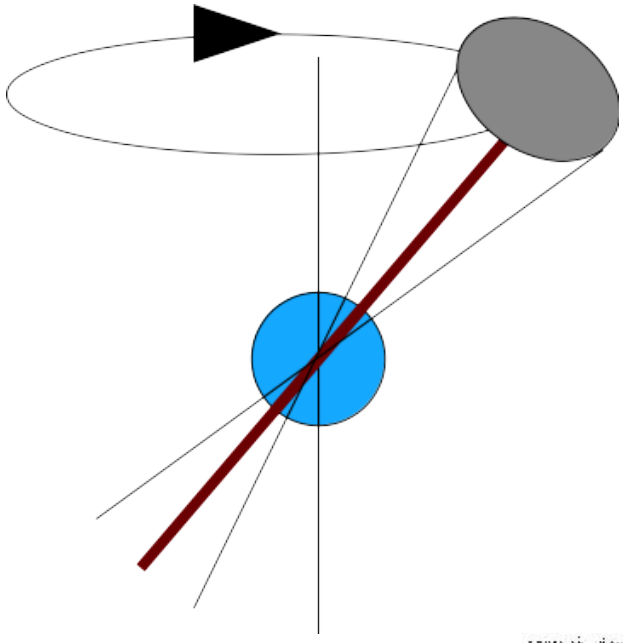
The Sun also contributes particles (below GeV).

Space weather influences Earth and human activity (solar storms).

Soho image of the corona with mass ejection and UV image of the Sun, simultaneous.



Pulsars

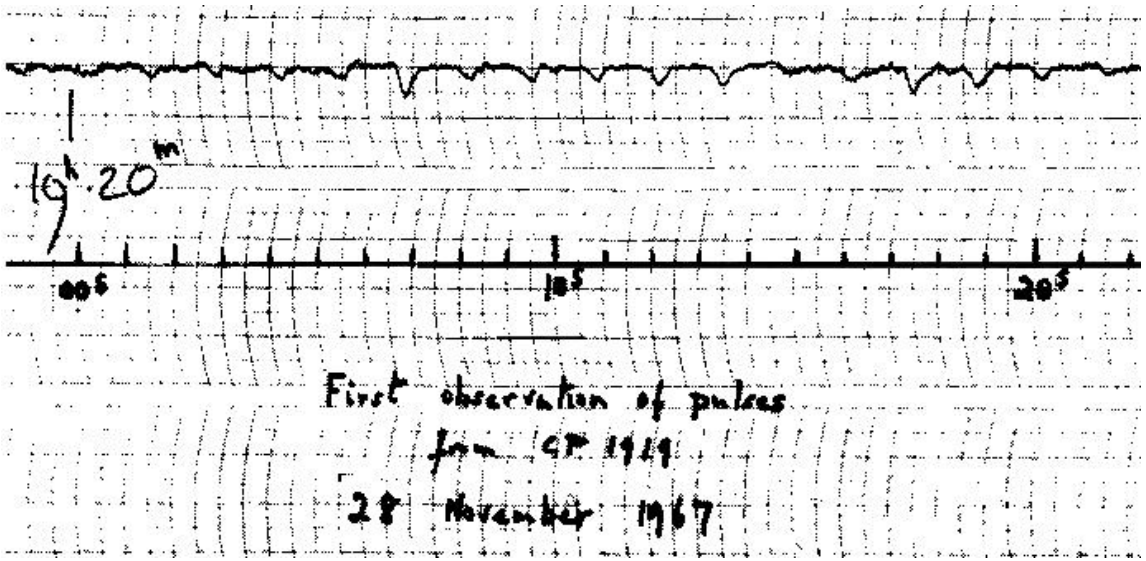


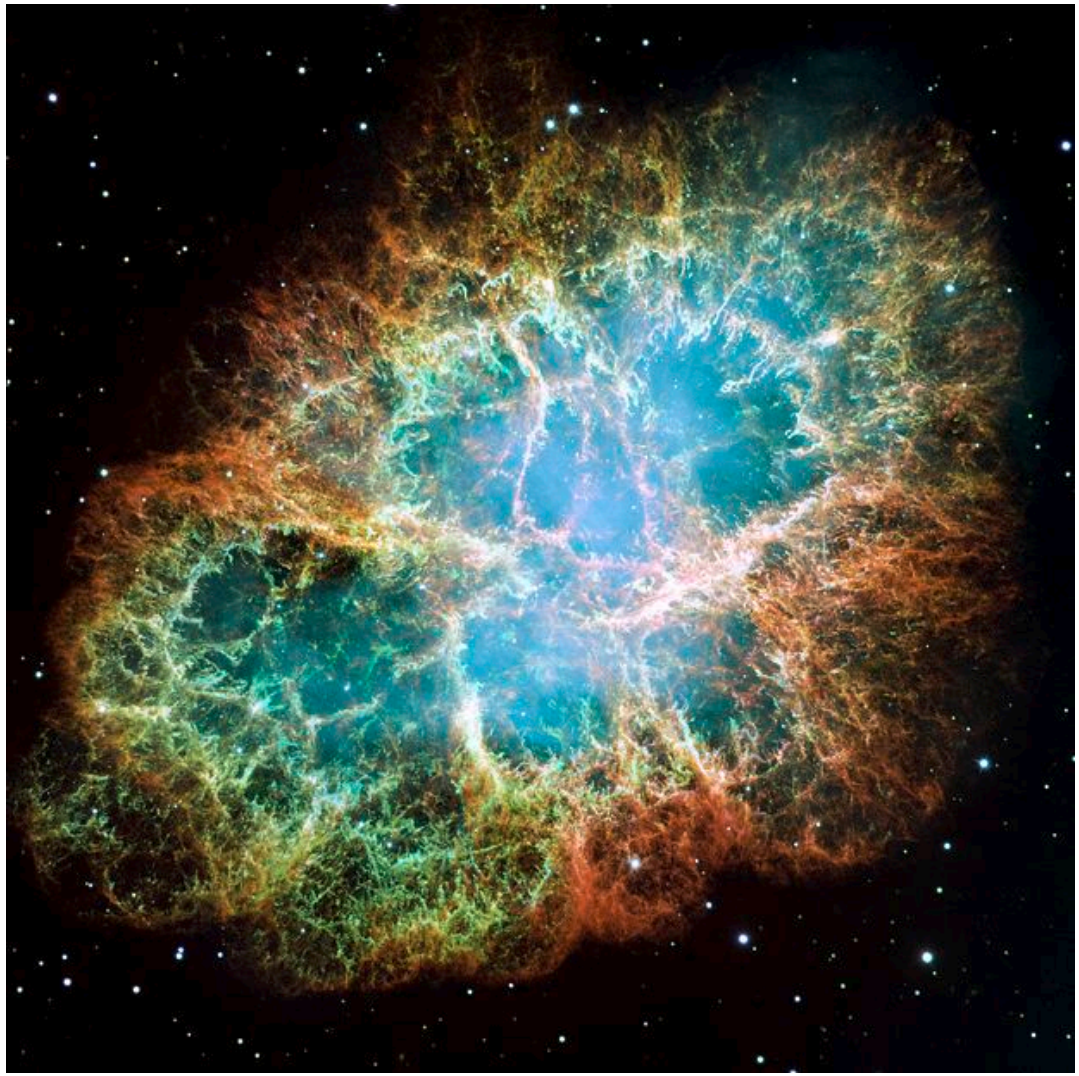
découverts en 1967
par J. Bell,
prix Nobel pour le directeur
de thèse A. Hewish en 1974

étoile de neutrons en rotation rapide

Cône de radiation

B~10^{12}G
high density

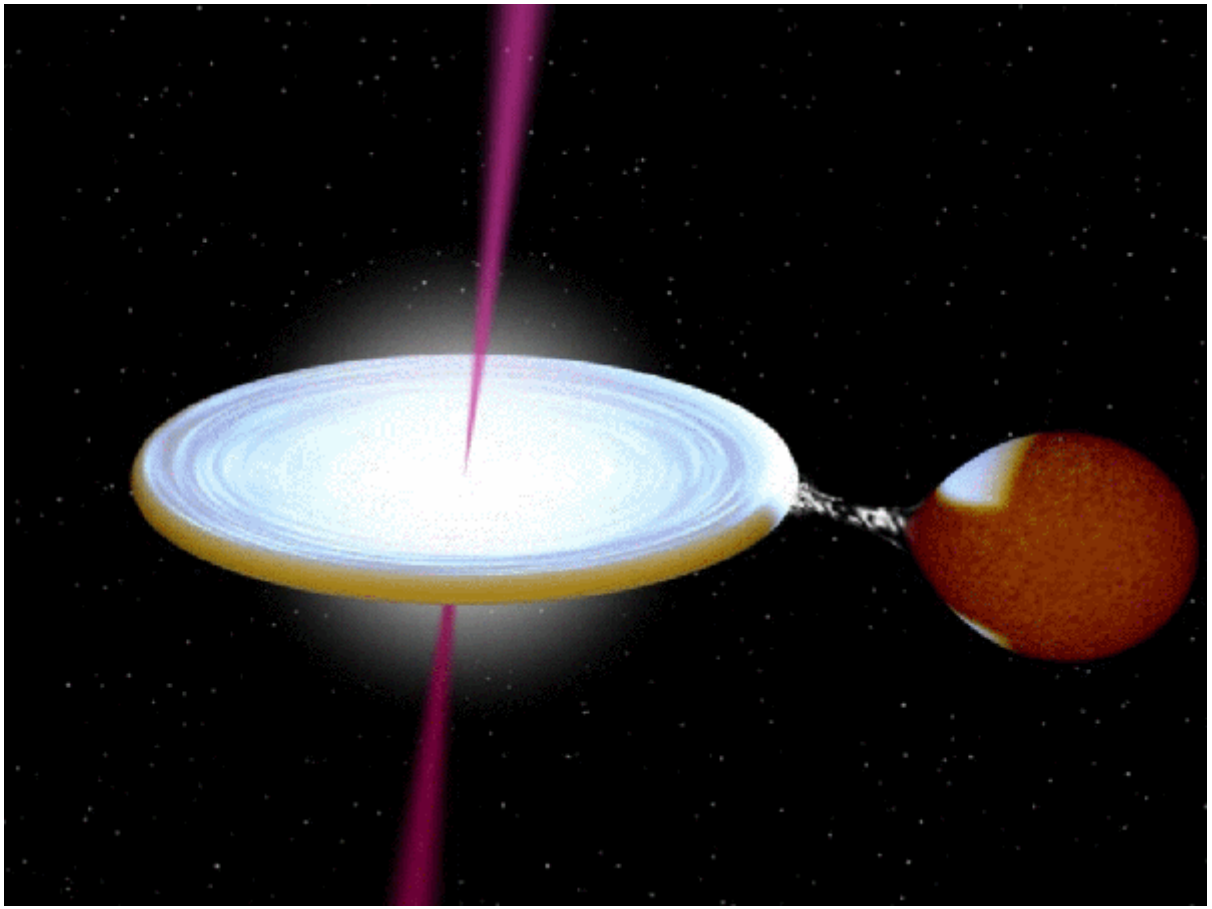




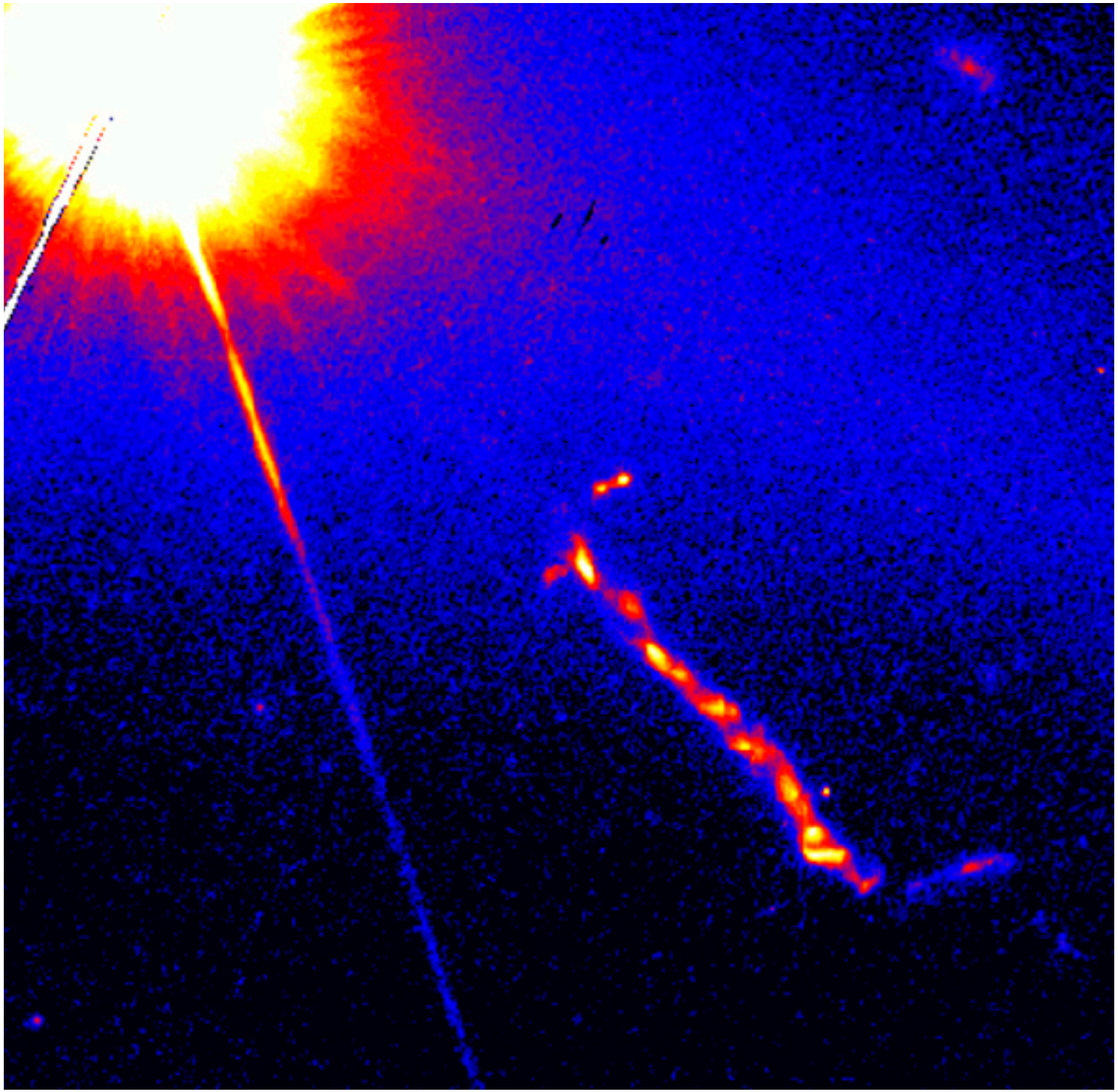
Crab nebula
born in 1054

hosts a pulsar

1962: Découverte d‘une source de rayons X brillante
Giacconi (prix Nobel in 2000)



Artist. repr.
of GRS1915+105



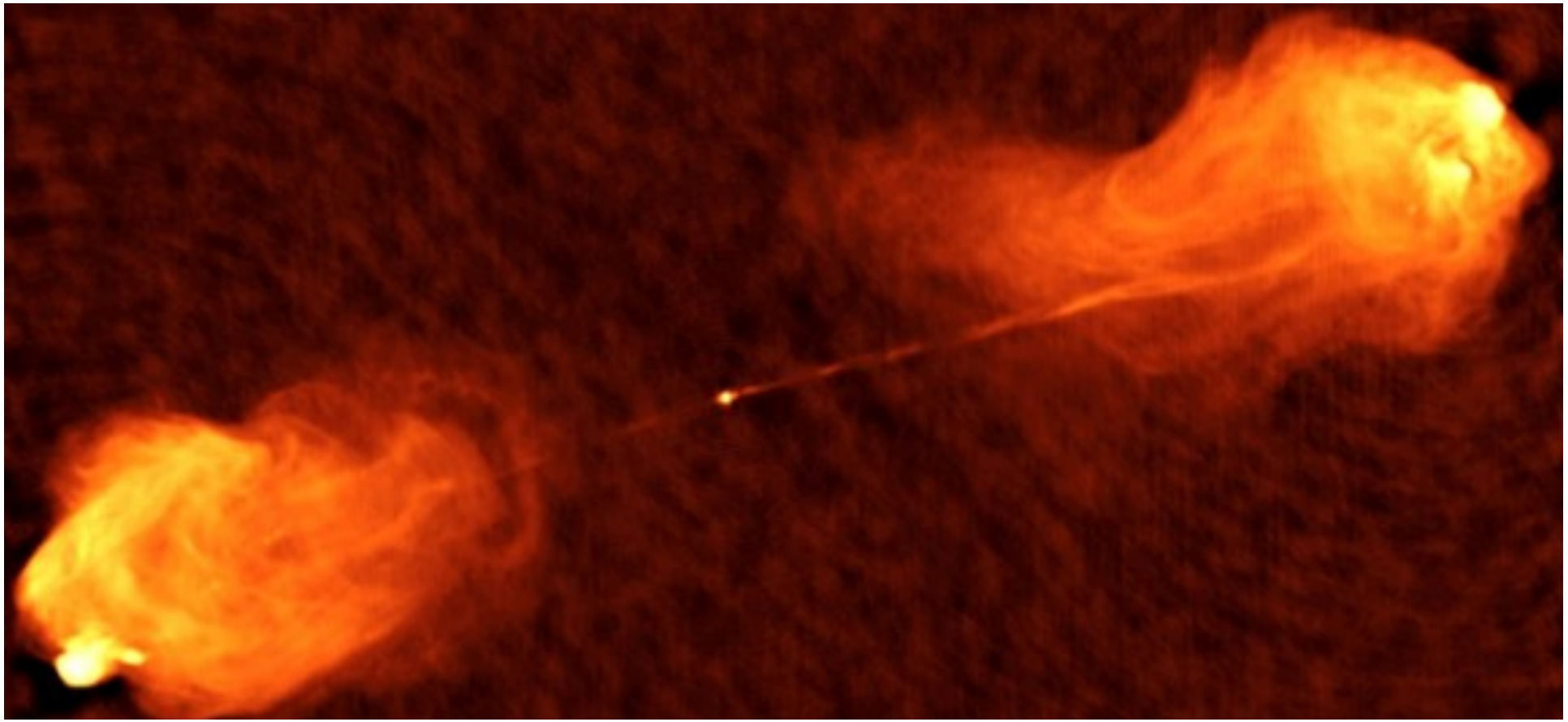
Quasar
3C 273
HST

10^{48}erg/s
découvert
1963

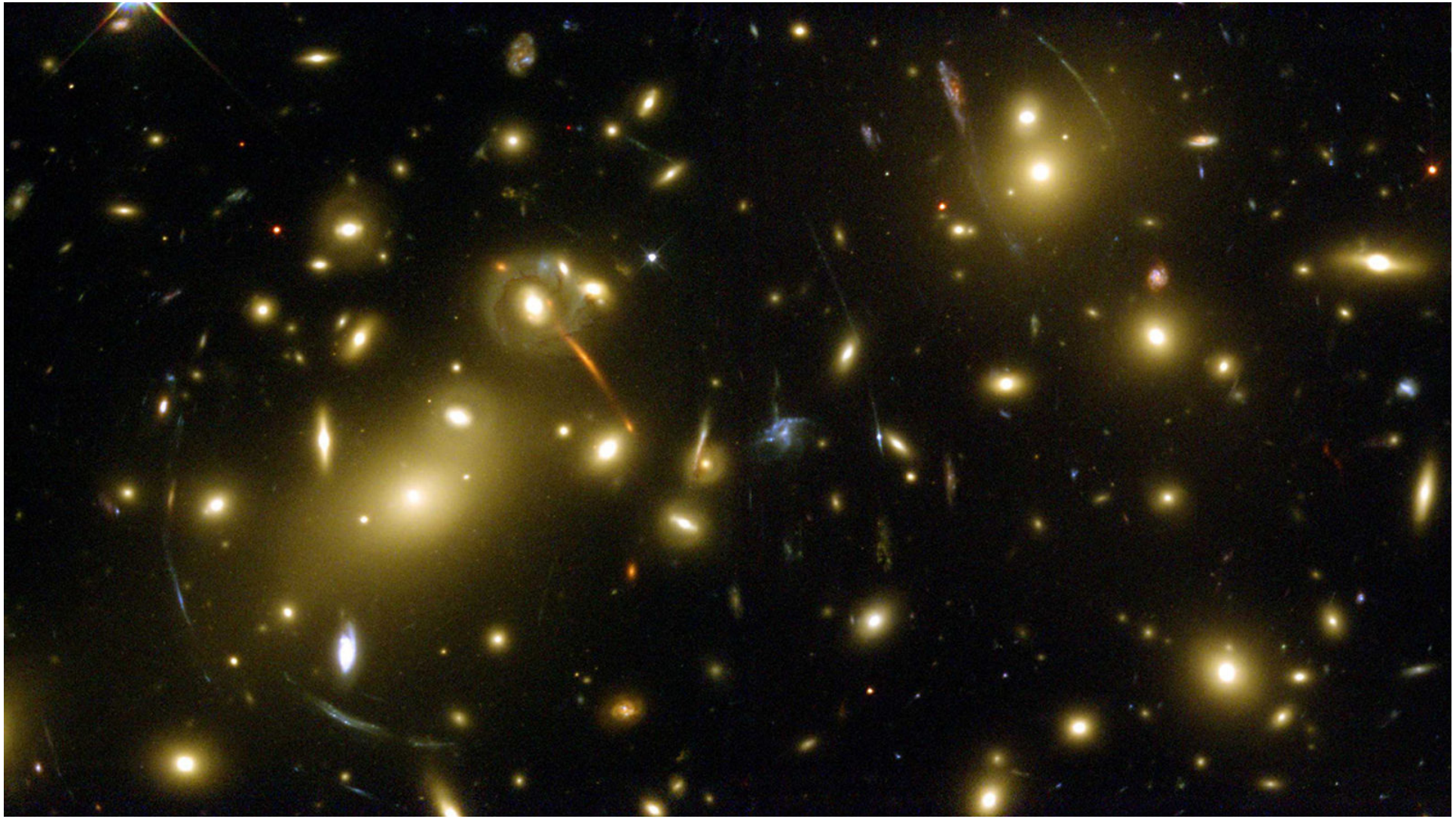
variable sur
des jours,
des mois,
des décennies

Radio galaxy Cygnus A, radio image, VLA.

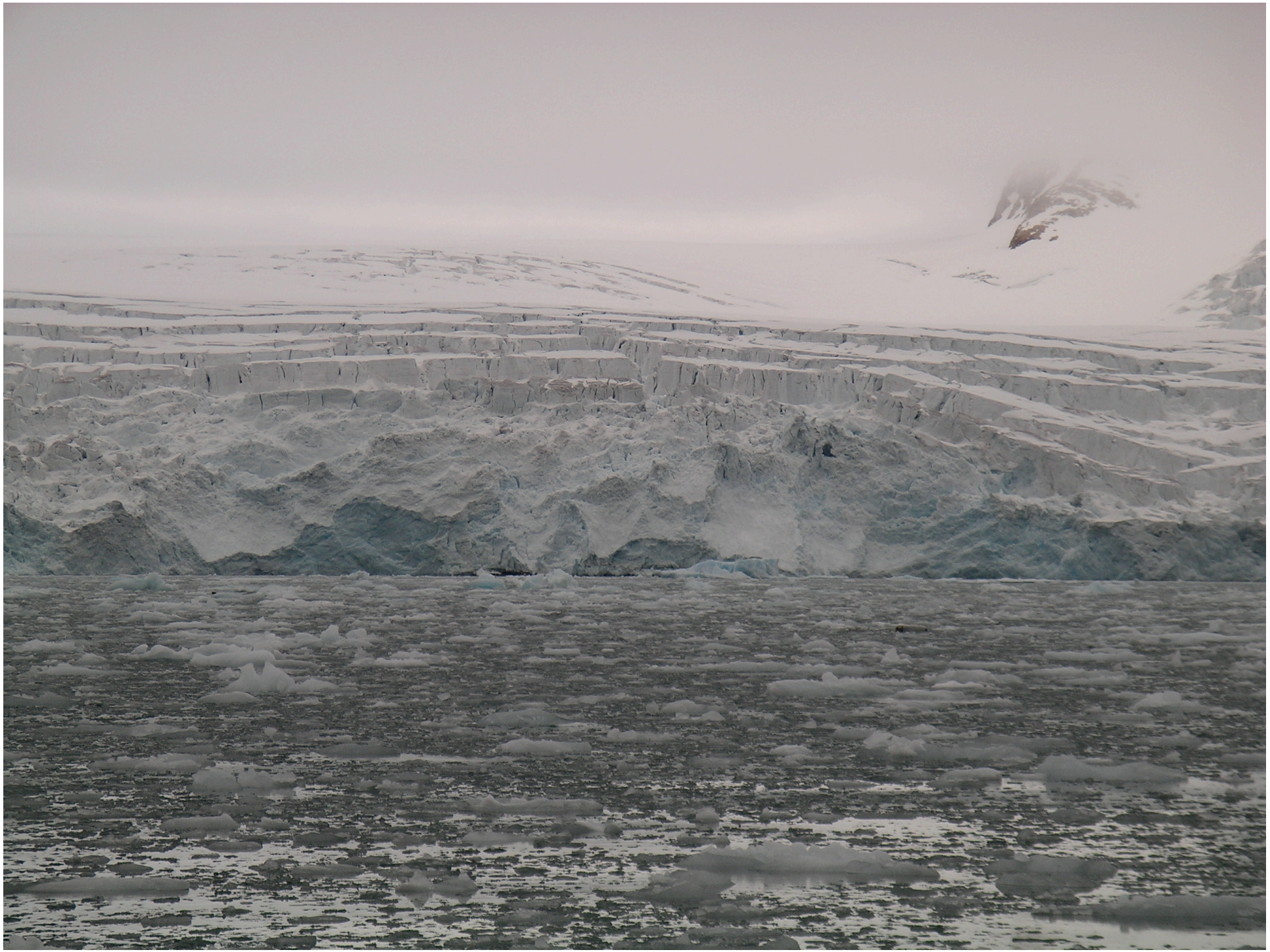
150 Mpc



Cluster of galaxies, HST.




HARKEN



More on lacouronnette.ch...

Mixing sailing and astrophysics is a real privilege.

Your project is very nice indeed.