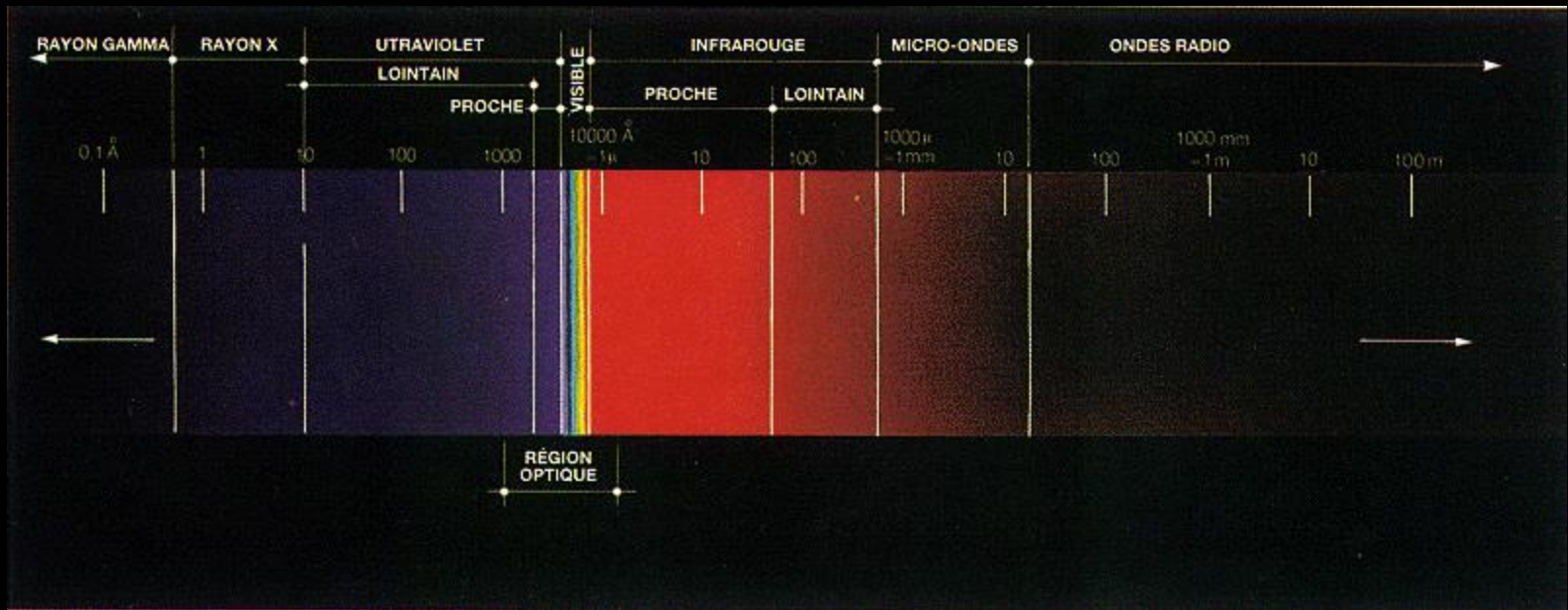


*Des étoiles aux atomes*

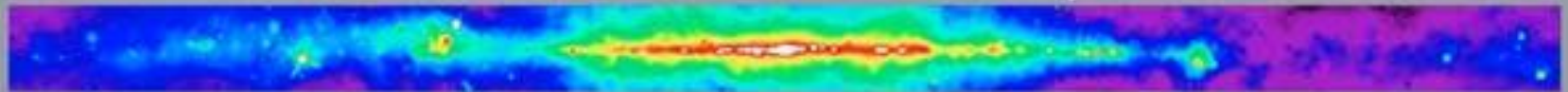






*Radio Continuum*

*408 MHz Bonn, Jodrell Banks, & Parkes*



*Atomic Hydrogen*

*21 cm Leiden-Dwingeloo, Maryland-Parkes*



*Radio Continuum*

*2.4-2.7 GHz Bonn & Parkes*



*Molecular Hydrogen*

*115 GHz Columbia-GISS*



*Infrared*

*12, 60, 100 μm IRAS*



*Near Infrared*

*1.25, 2.2, 3.5 μm COBE/DIRBE*



*Optical*

*Laustsen et al. Photomosaic*



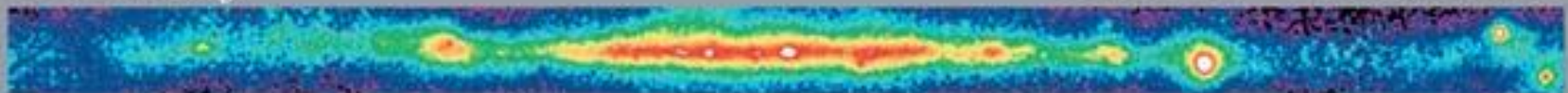
*X-Ray*

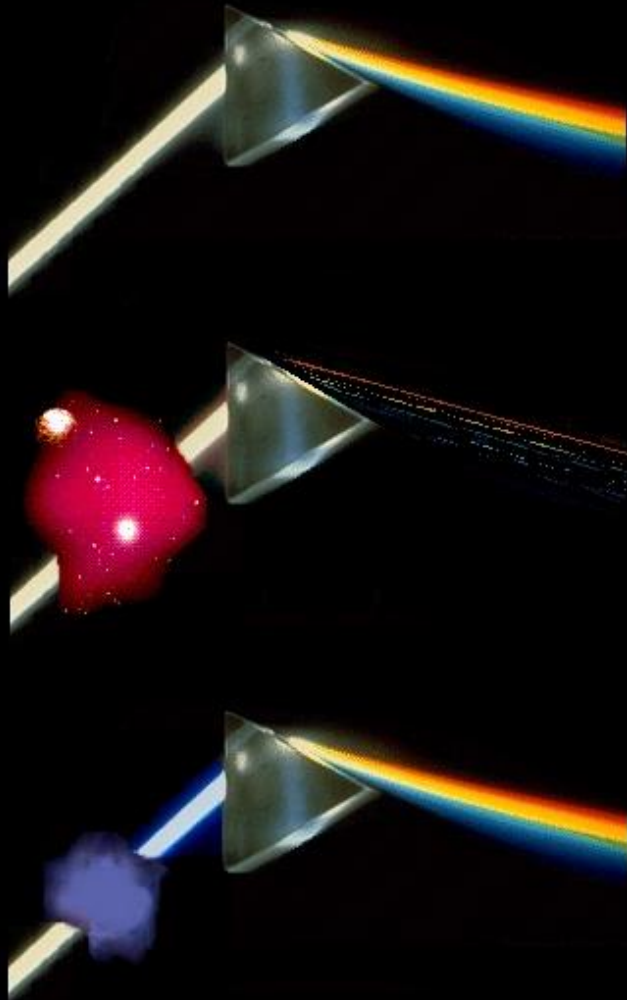
*0.25, 0.75, 1.5 keV ROSAT/PSPC*



*Gamma Ray*

*>100 MeV CGRO/EGRET*





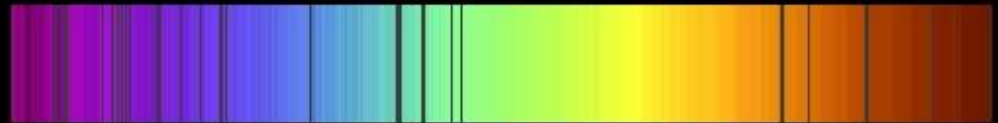
**Spectre continu**



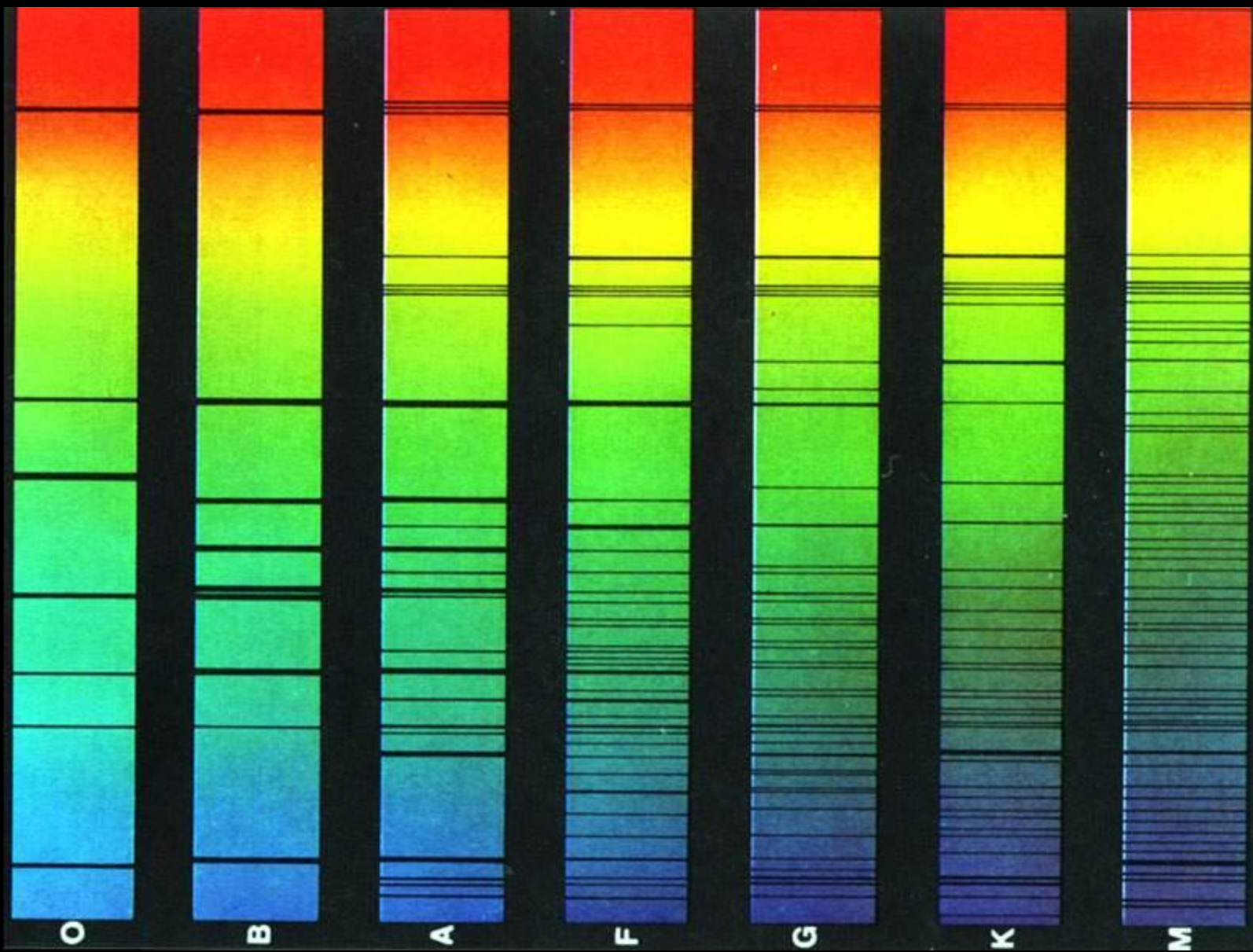
**Spectre d'émission**



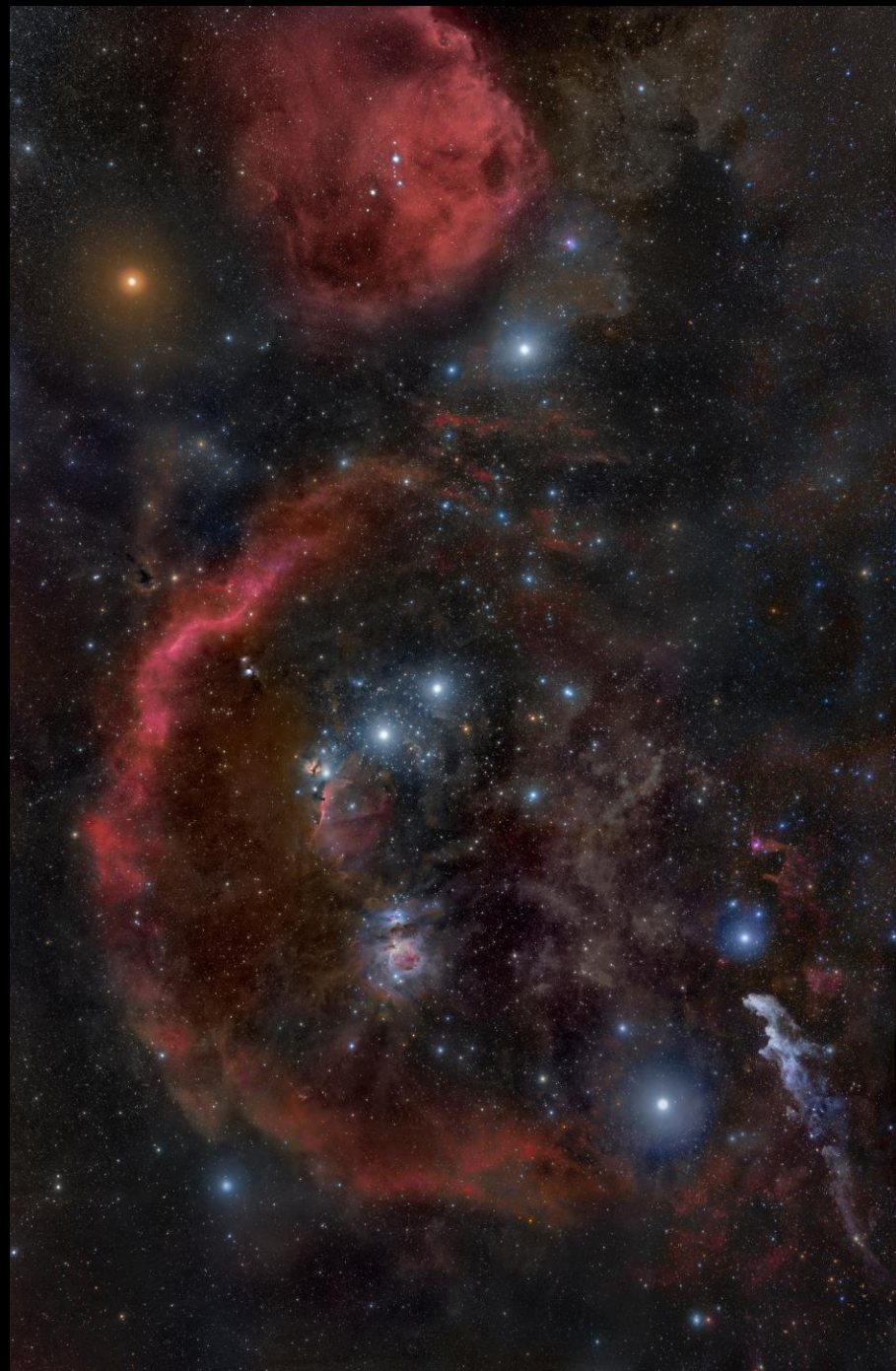
**Spectre d'absorption**











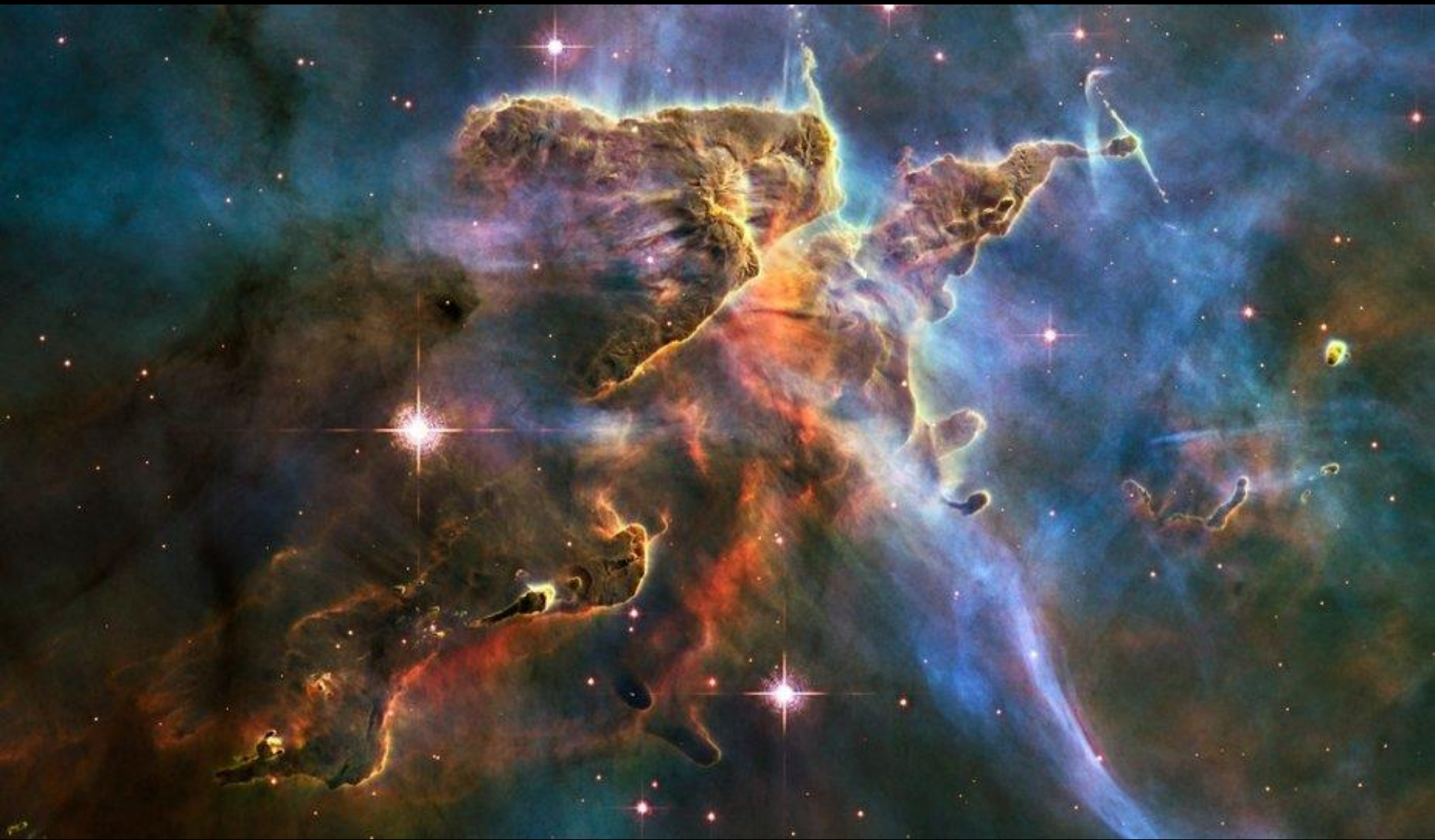








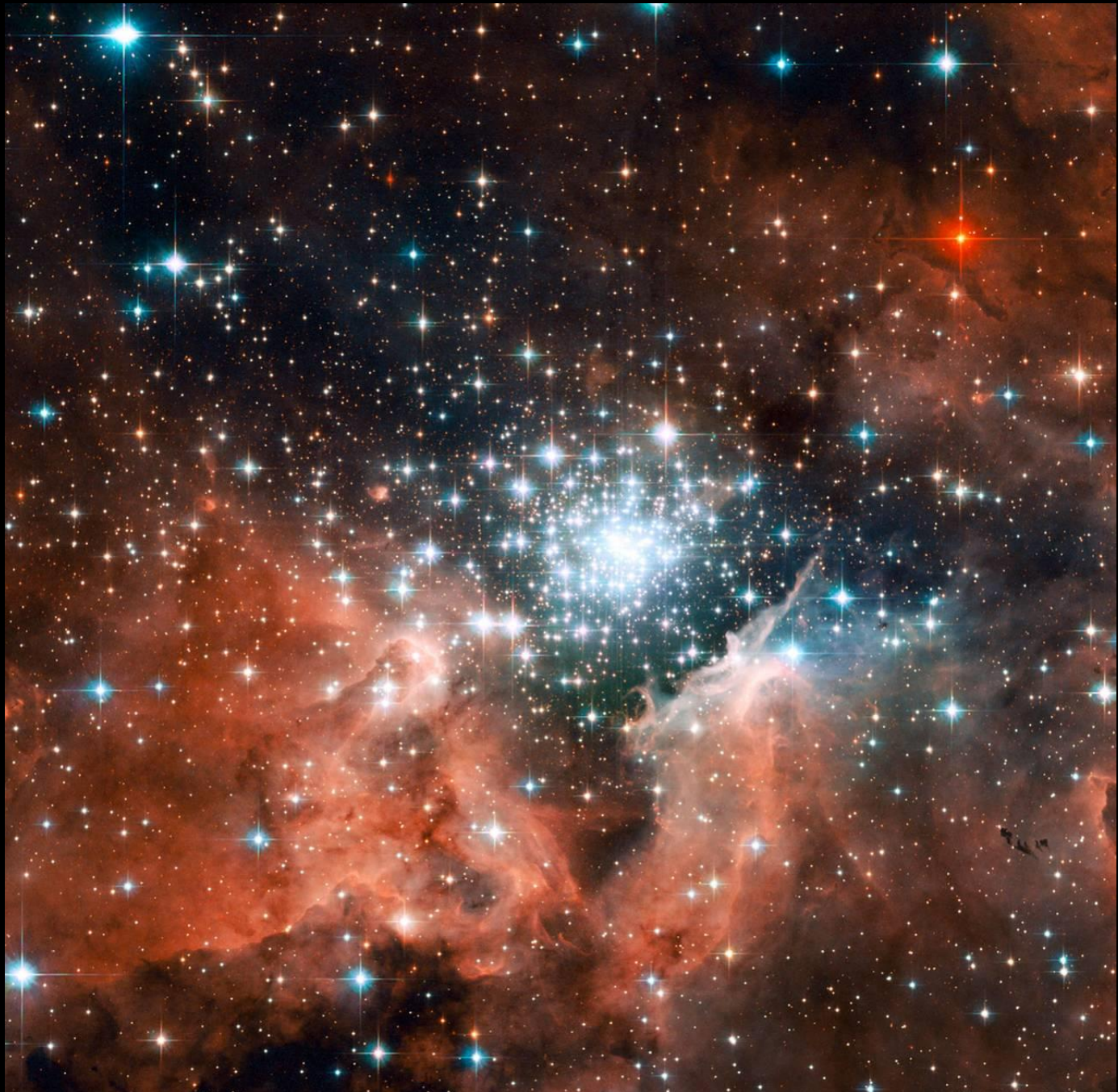




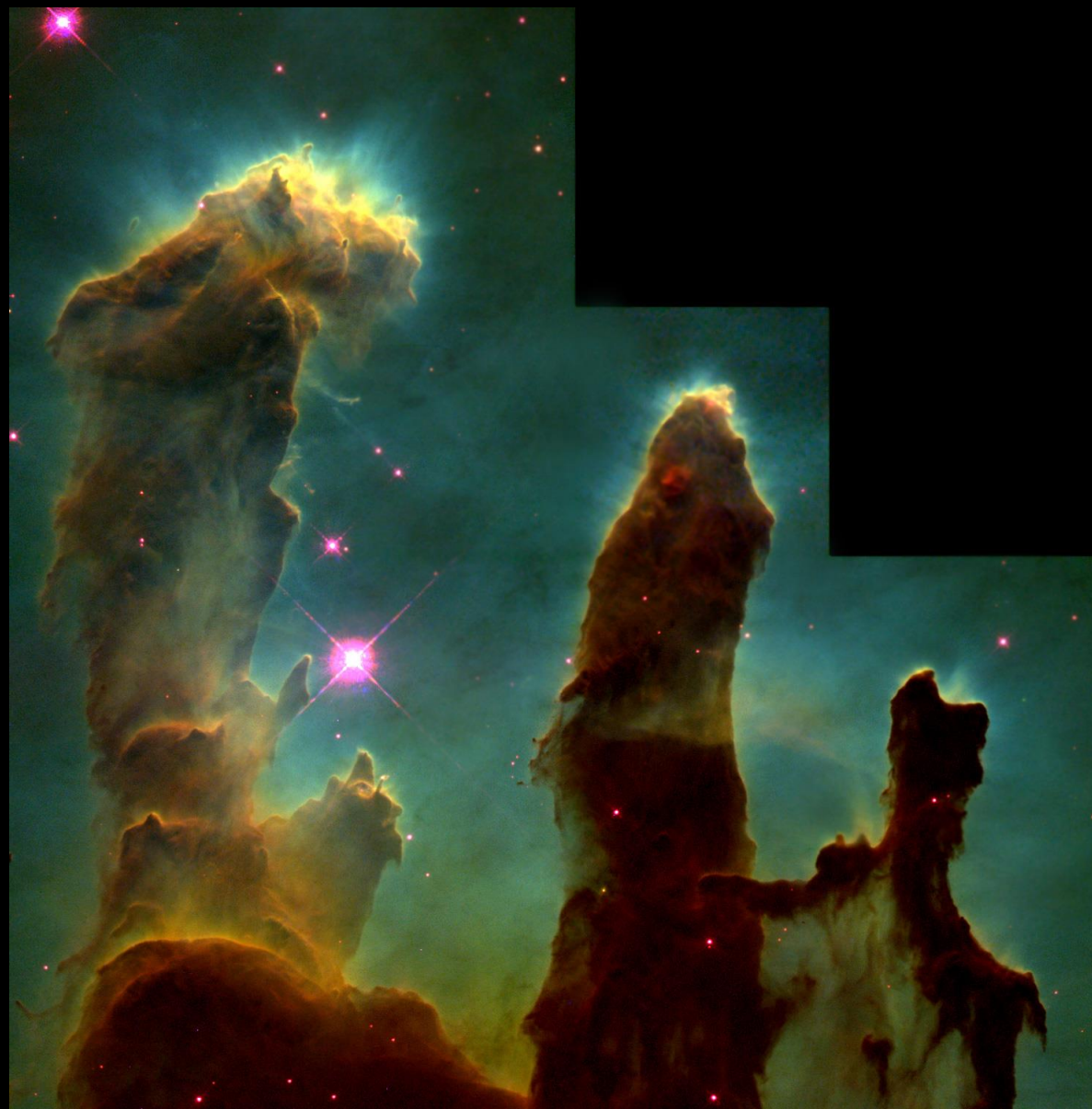




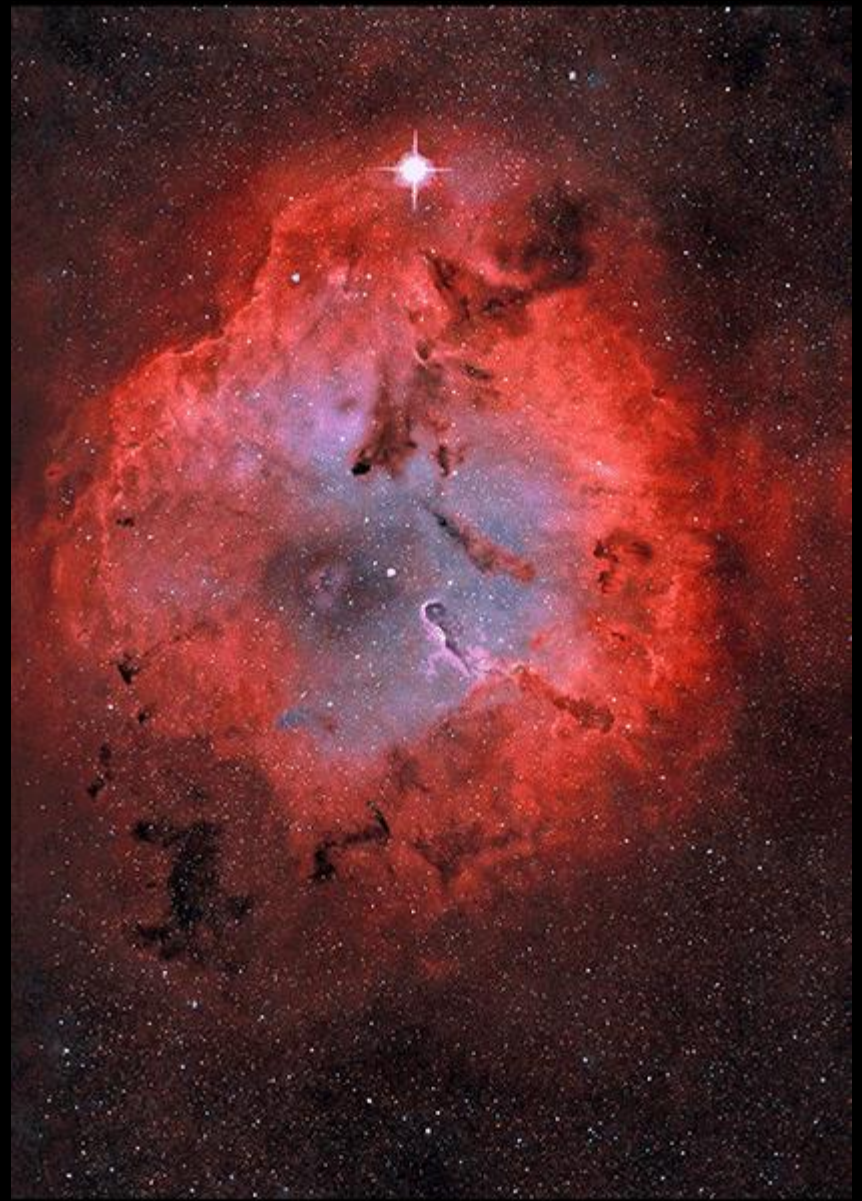
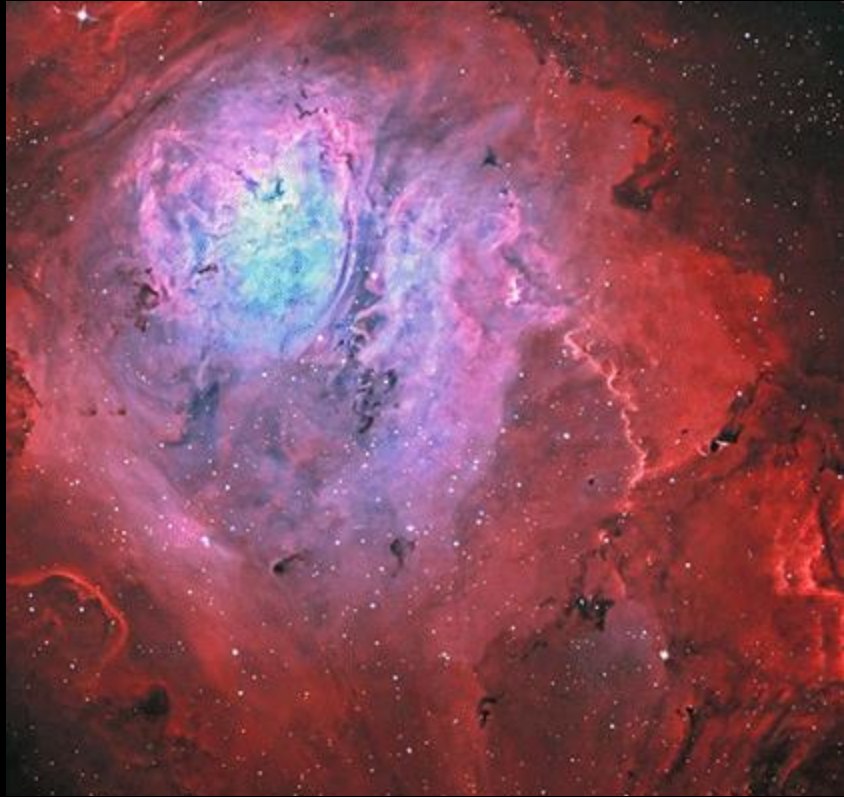










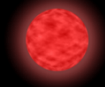




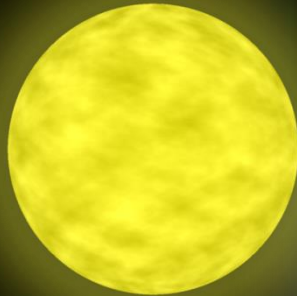


# Des étoiles de toutes dimensions et de toutes les couleurs

Naine rouge  
0,08 masse solaire



Etoile solaire  
Environ 1 masse solaire

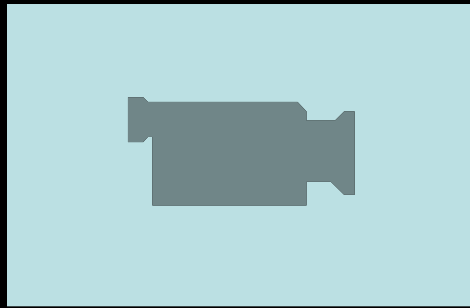


Géante bleue  
Jusqu'à 150 Masses  
solaires



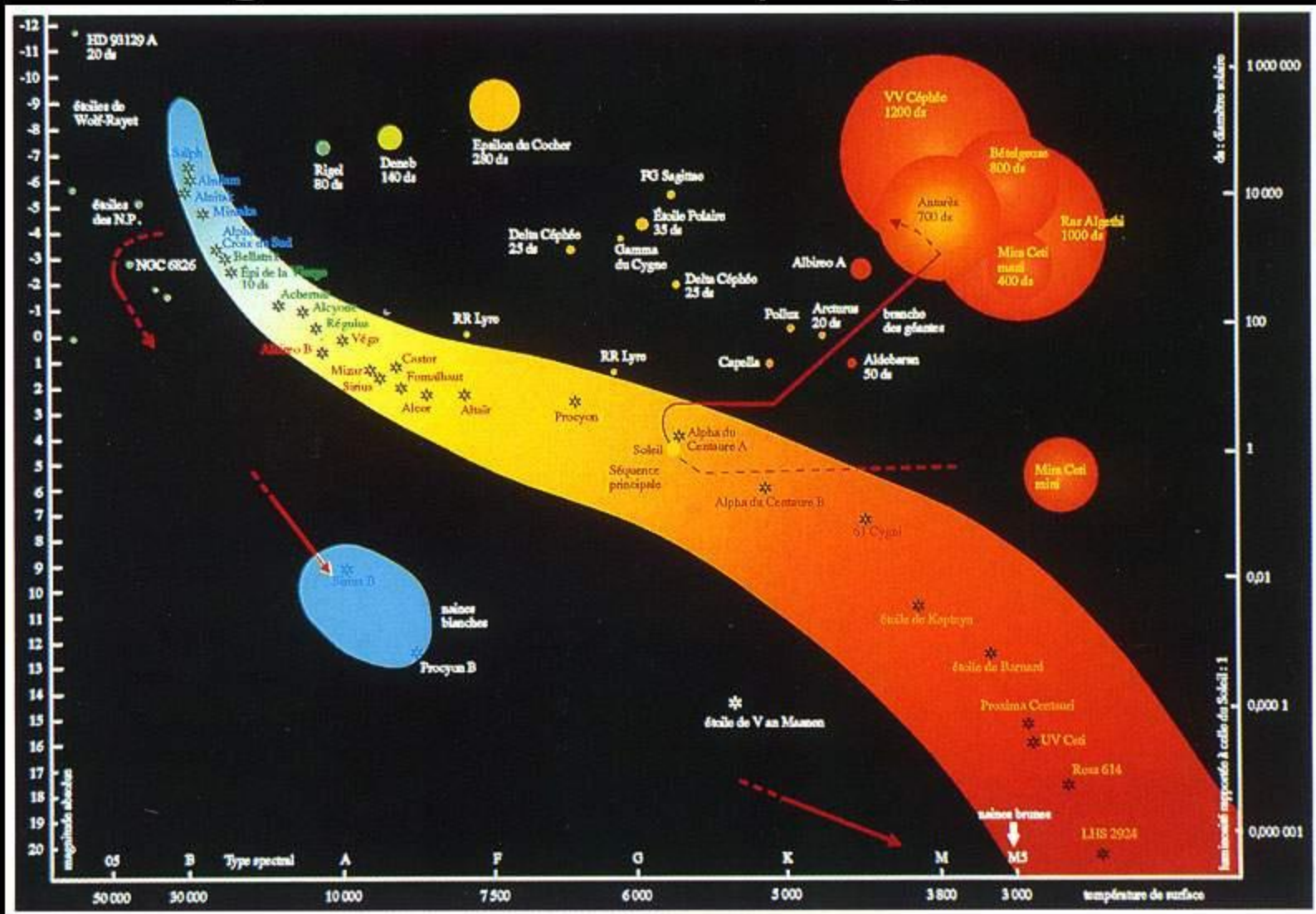


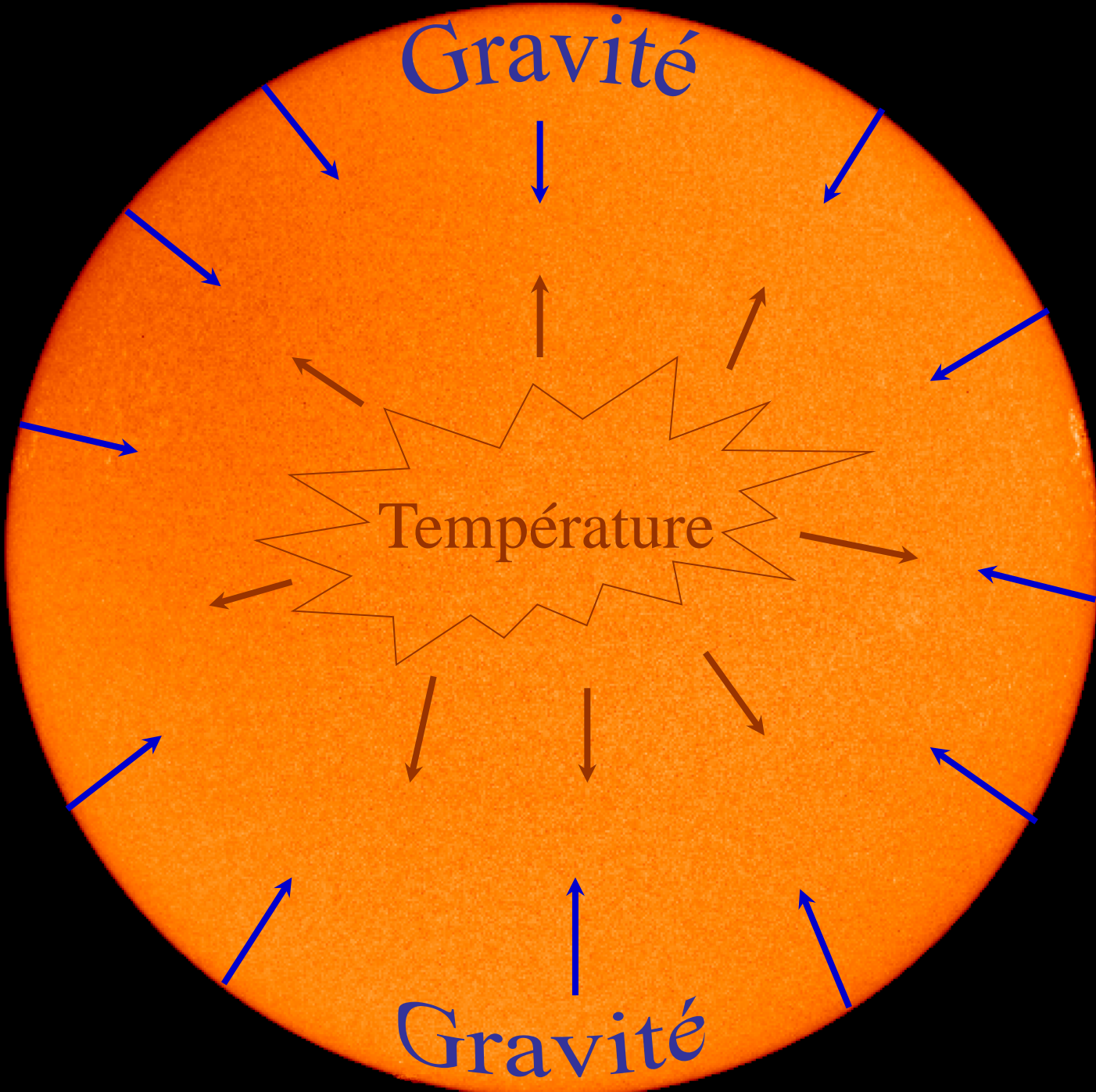






# Diagramme de Hertzsprung-Russell



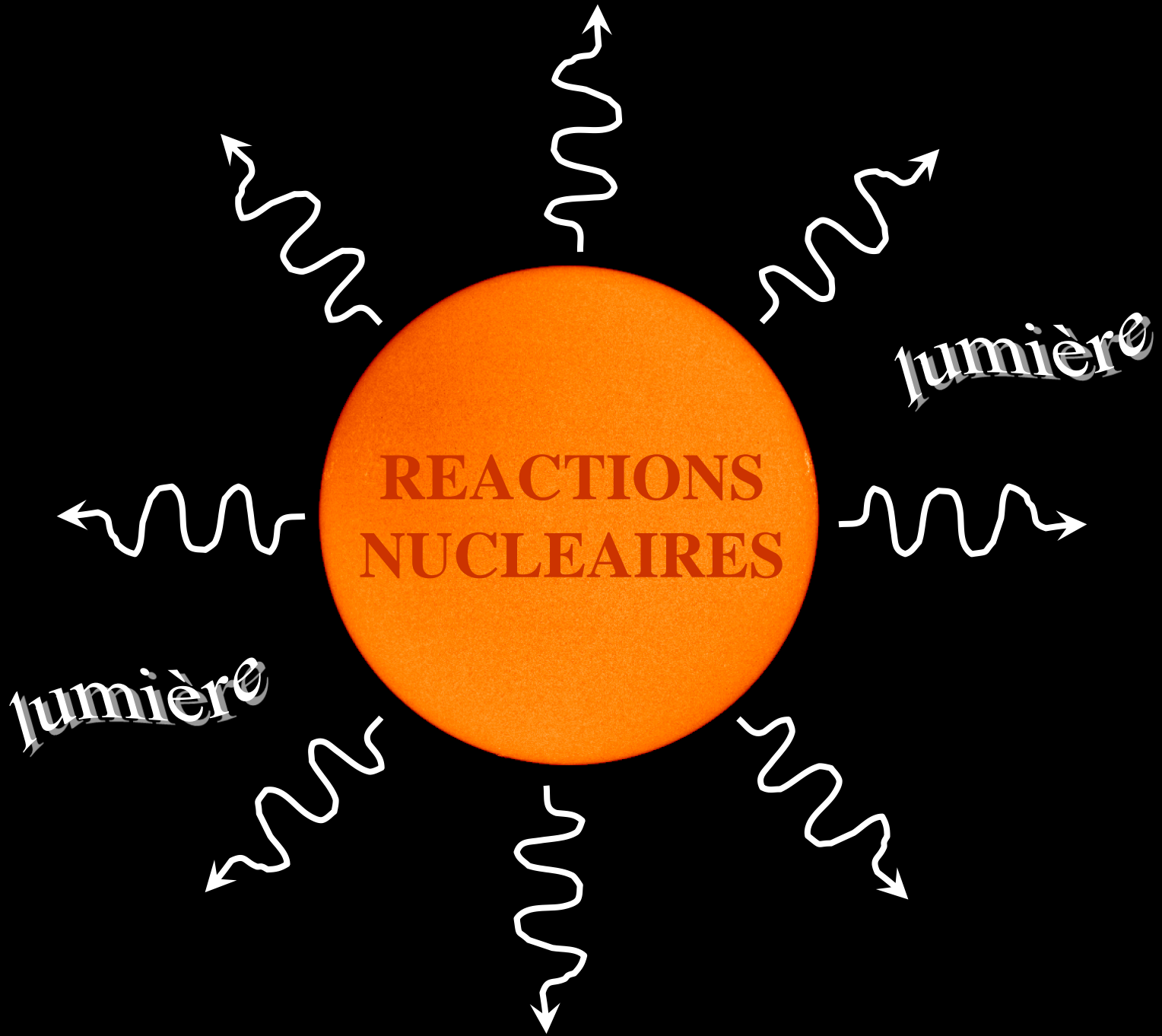


Gravité

Température

Gravité







T.Lombry



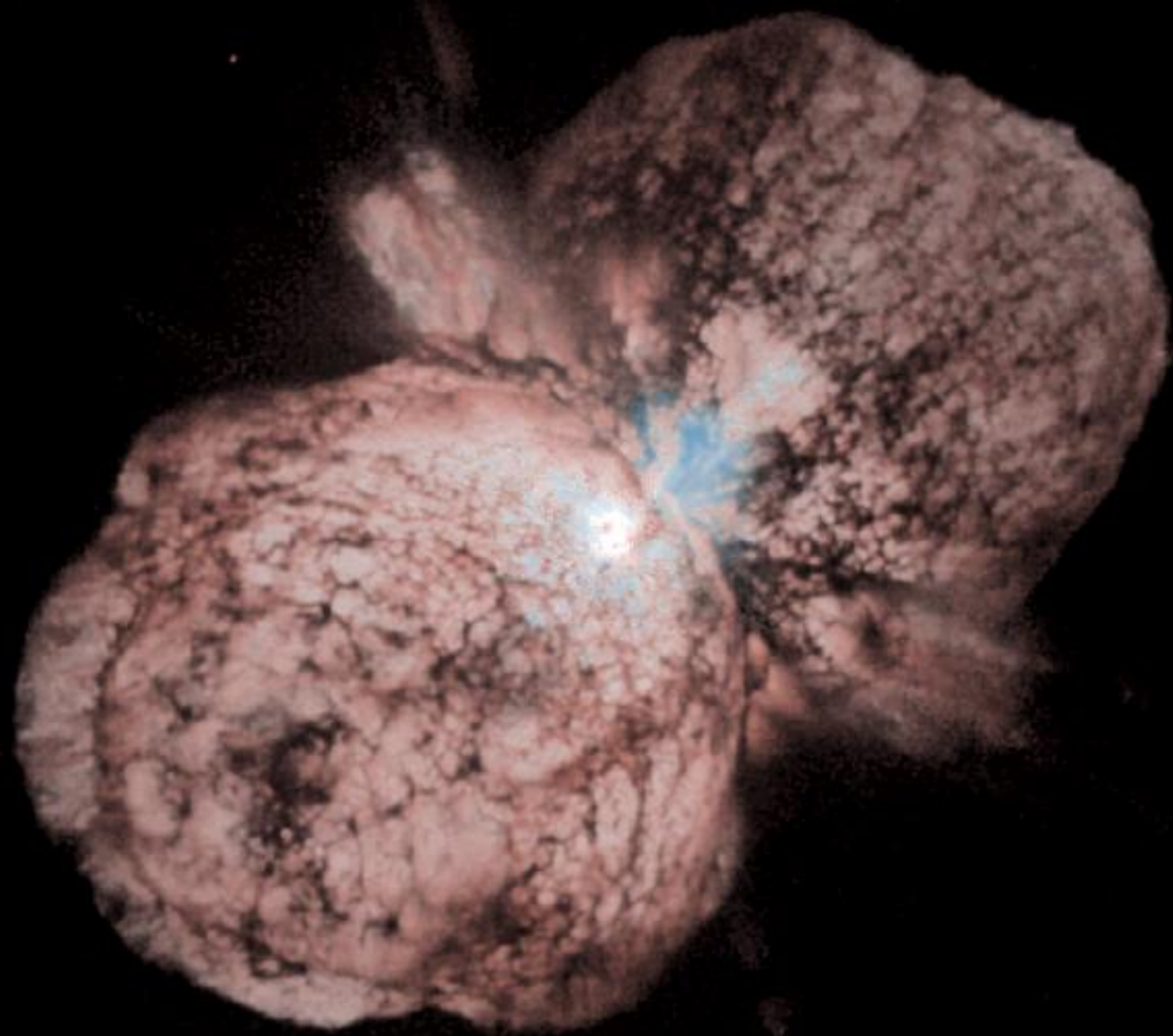
© 2014











HYDROGENE

HYDROGENE ->  
HELIUM





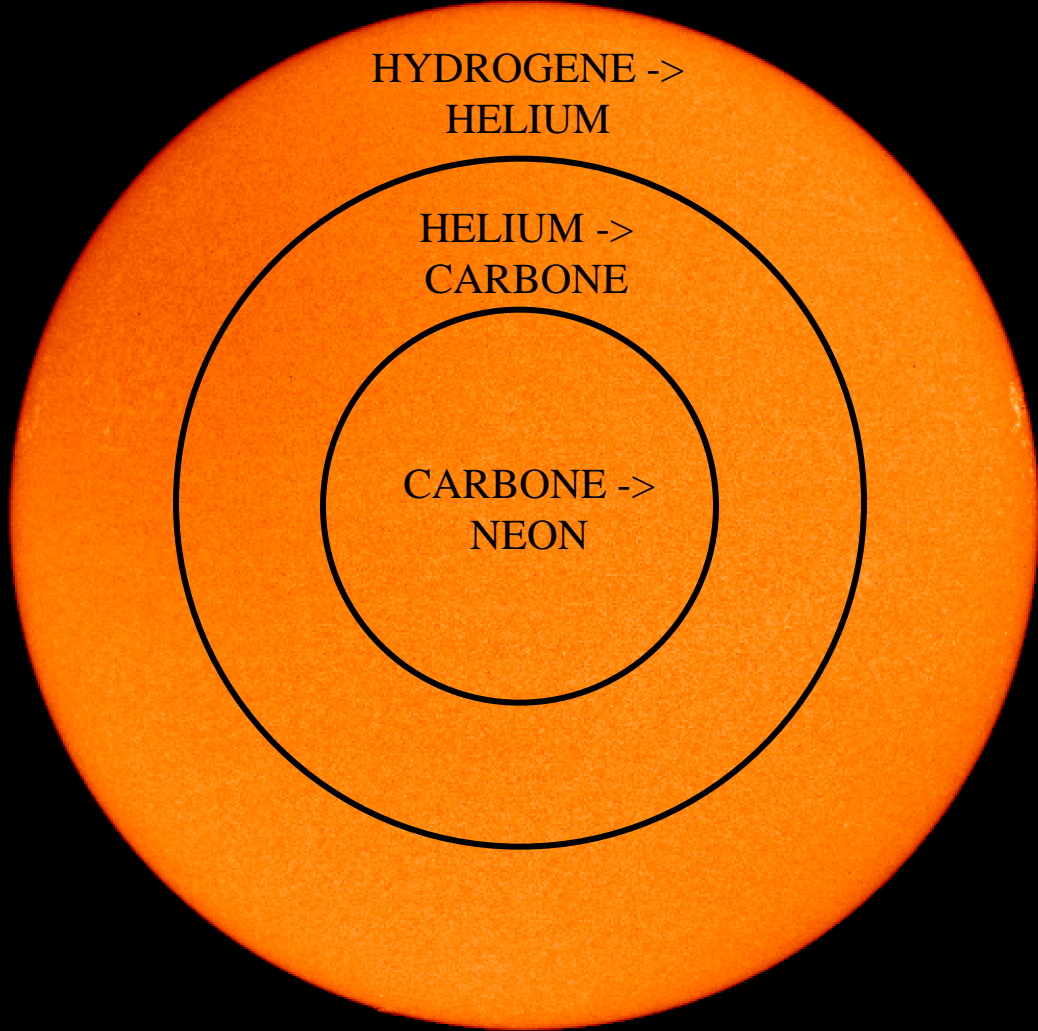
HYDROGENE ->  
HELIUM

HELIUM ->  
CARBONE

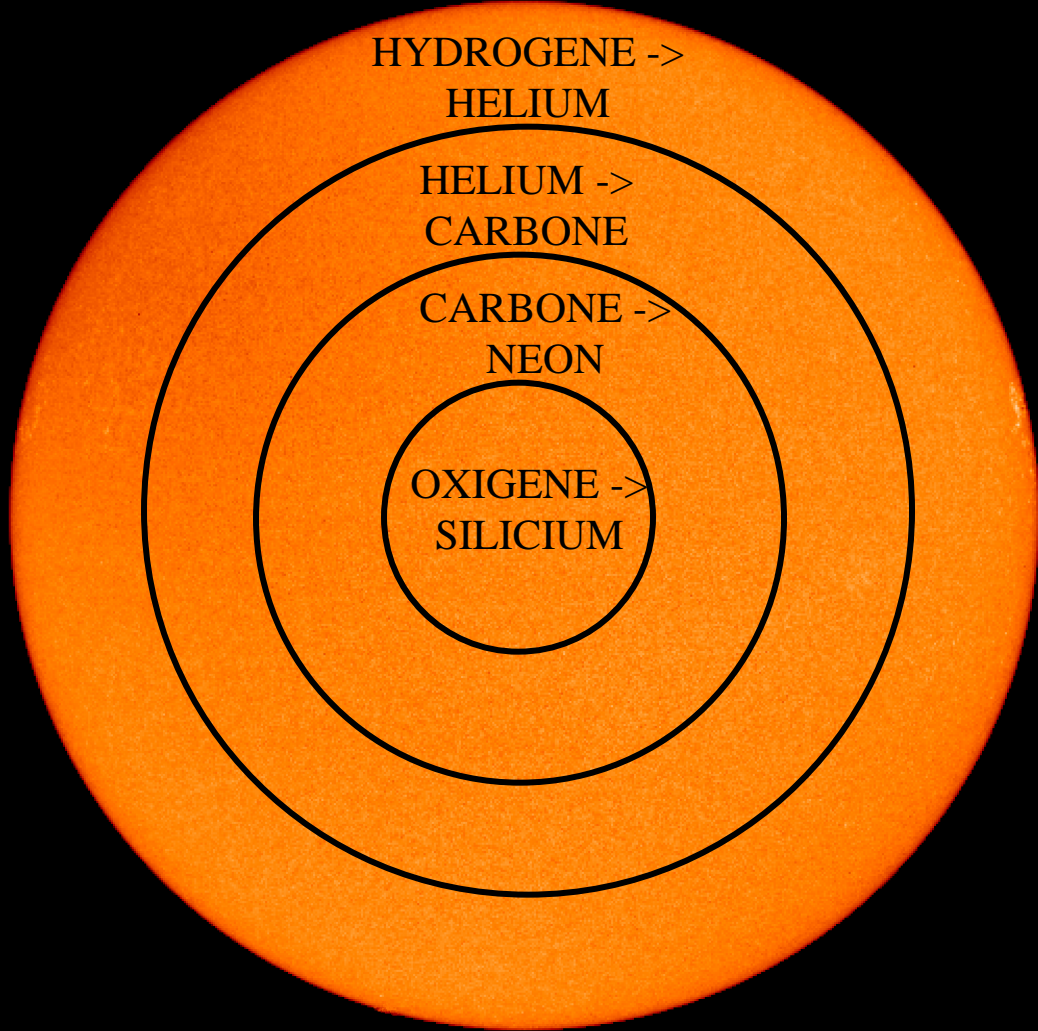
HYDROGENE ->  
HELIUM

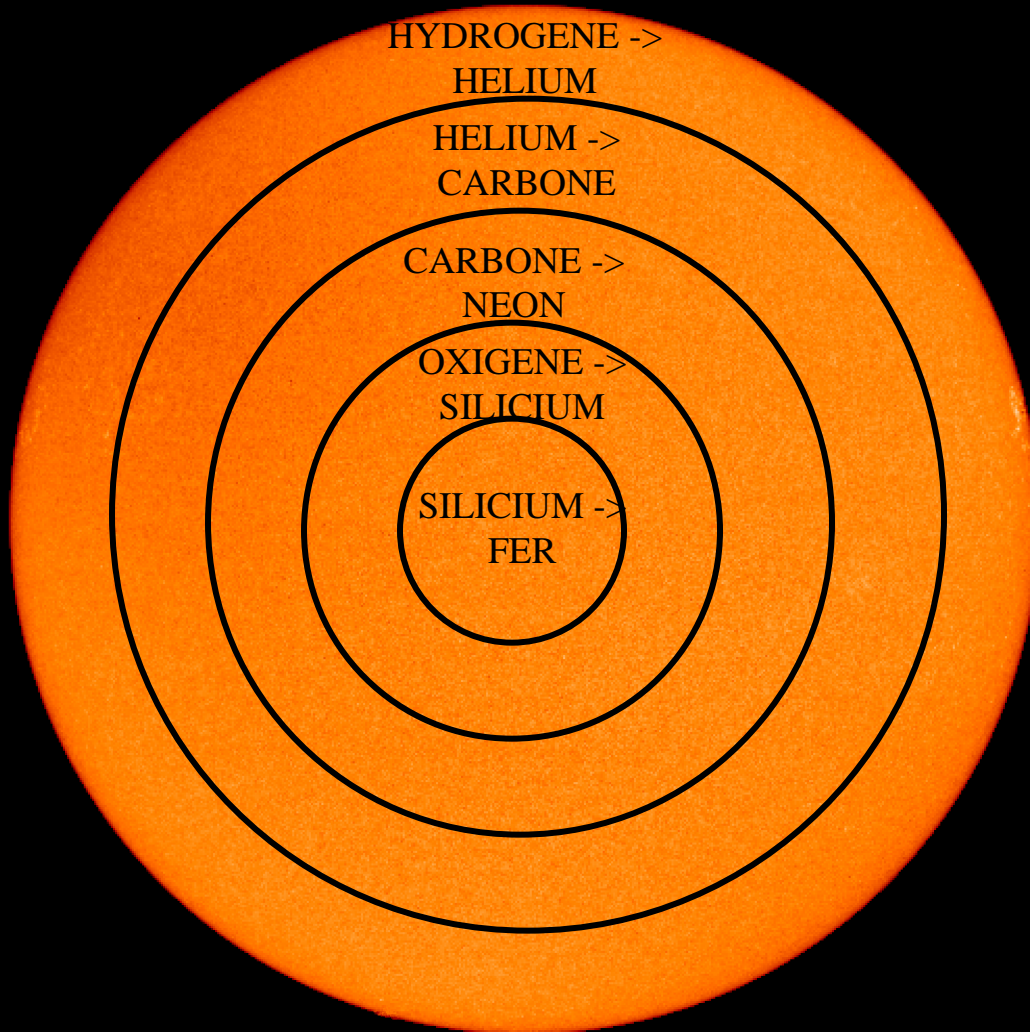
HELIUM ->  
CARBONE

CARBONE ->  
NEON





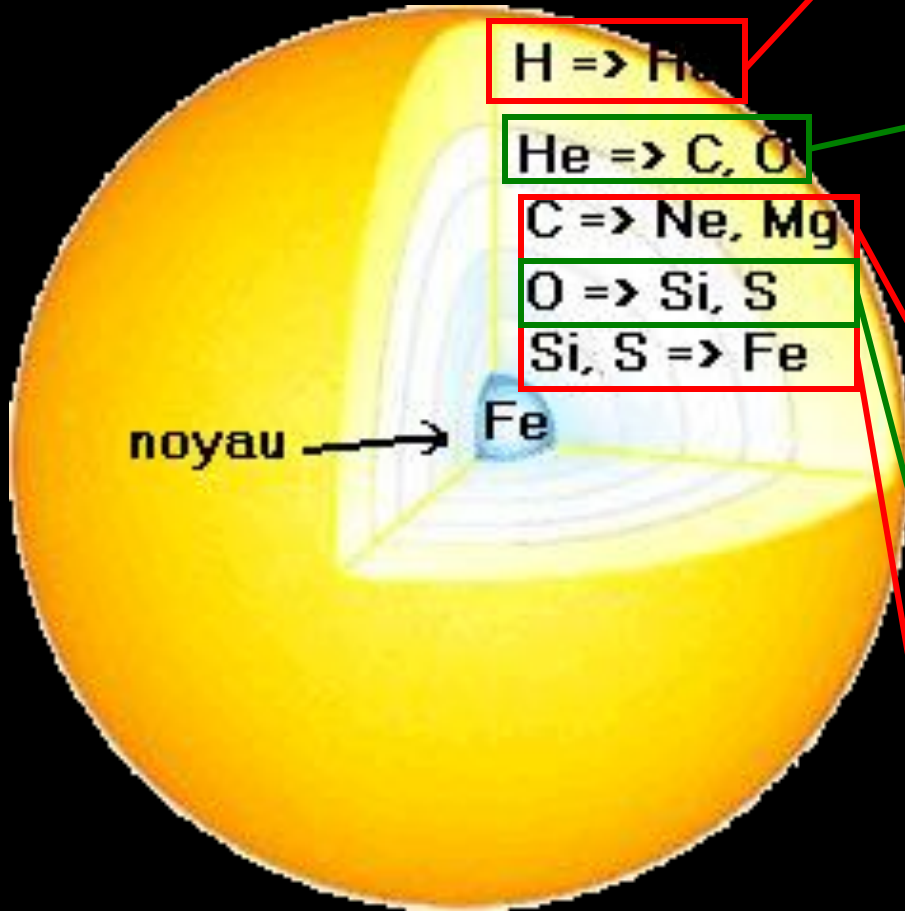




FER = ELEMENT LE PLUS STABLE



# Étoile de 25 fois la masse du soleil



15 millions de degrés

7 millions d'années

H ⇒ He

100 millions de degrés

500.000 ans

He ⇒ C, O

C ⇒ Ne, Mg

O ⇒ Si, S

Si, S ⇒ Fe

500 millions de degrés

600 ans

2 milliards de degrés

6 mois

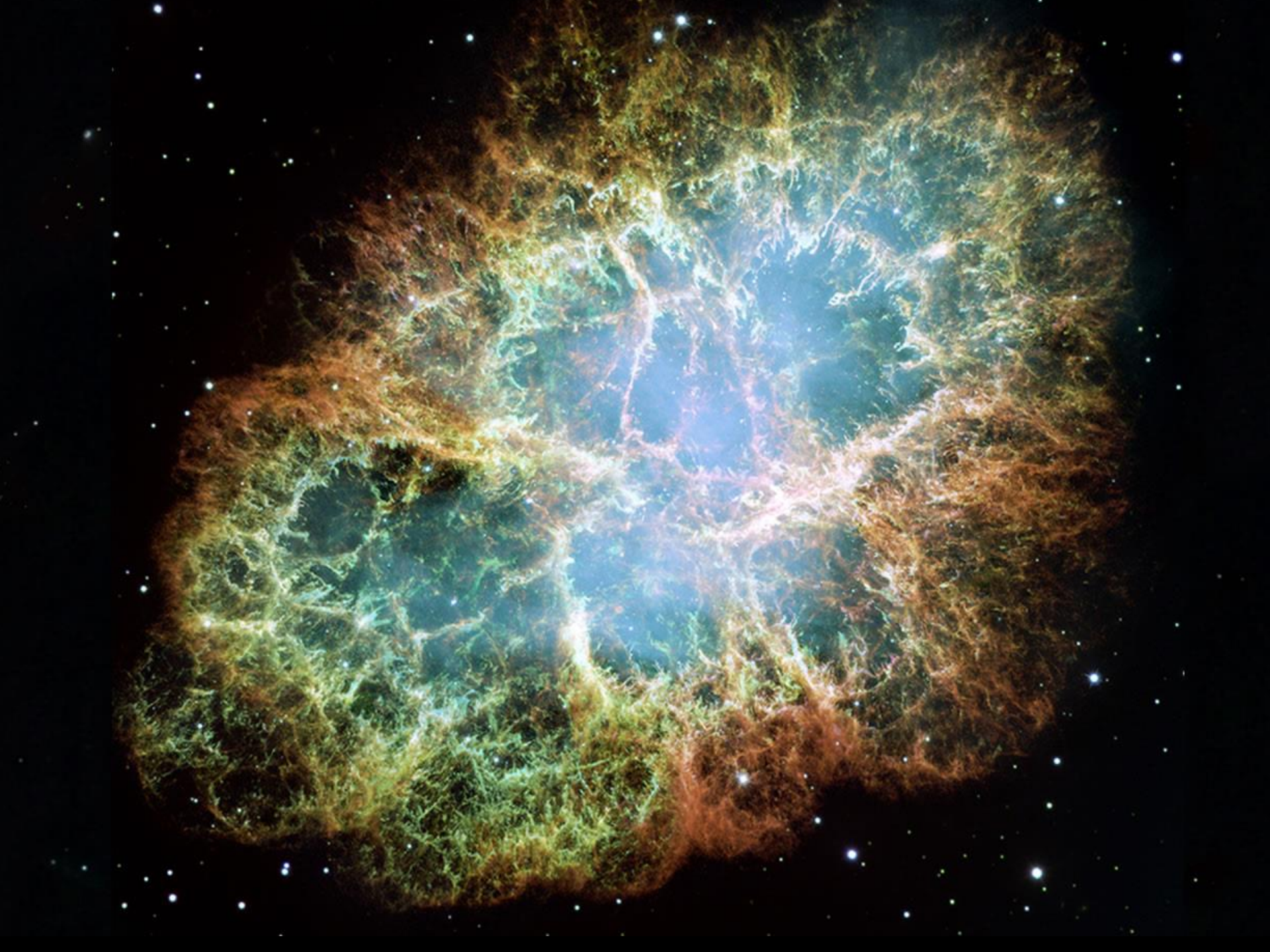
3 milliards de degrés

1 jour

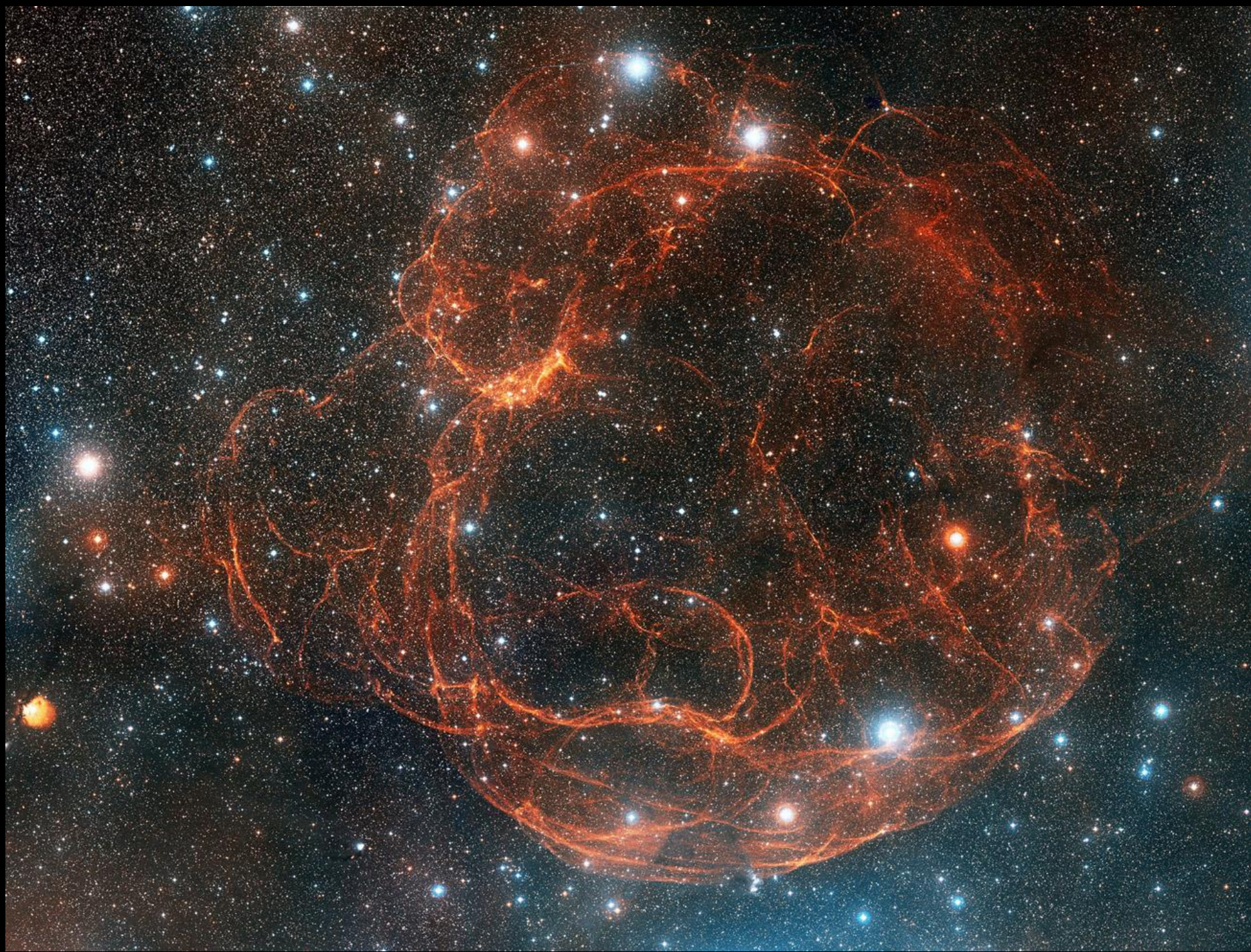










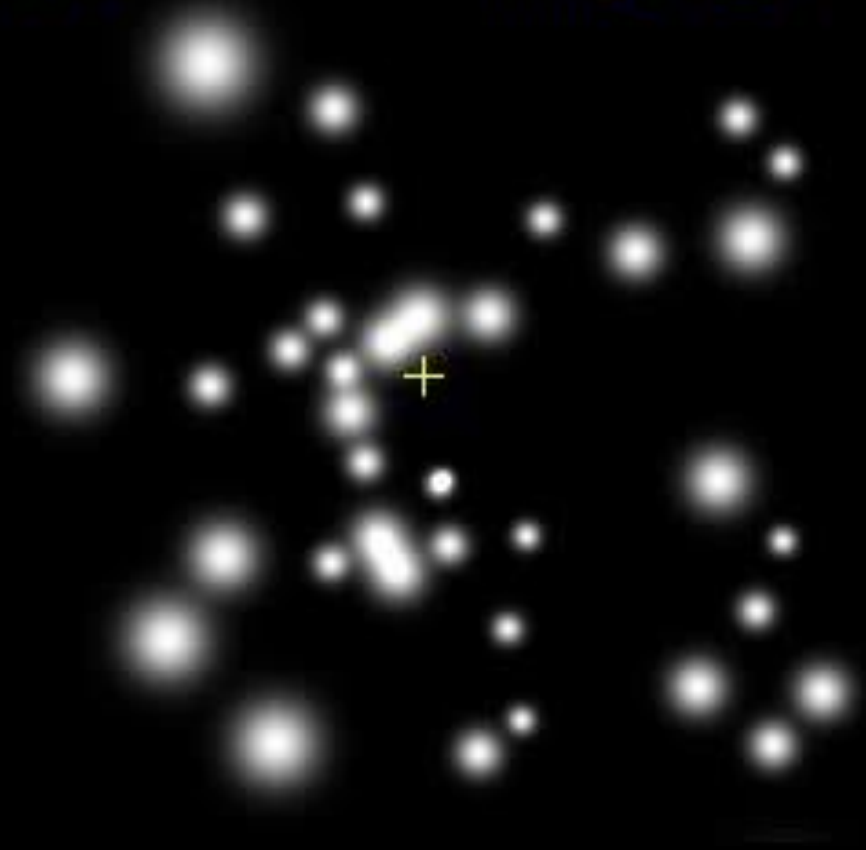


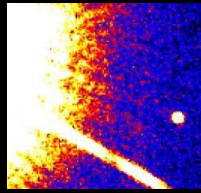




1992

10 light days





Masse non suffisante pour fusionner son hydrogène

$T^\circ = 1000^\circ\text{C}$

Durée de vie : plusieurs dizaines de milliards d'années

*Fin de vie :*

inconnue

Naines brunes

$M < 0.08 M_s$

Nébuleuses diffuses



Naines rouges  $M : > 0.08 \text{ à } < 0.7 M_s$

$T^\circ = 3000^\circ\text{C}$

Durée de vie : plusieurs dizaines de milliards d'années

*Fin de vie :* inconnue



Étoiles de type solaire

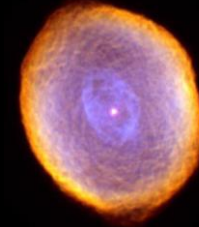
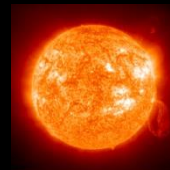
$M : > 0.7 \text{ à } 6 M_s$

$T^\circ = \text{environ } 6000^\circ\text{C}$

Durée de vie : jusqu'à 20 milliards d'années

*Fin de vie :*

Géante rouge, nébuleuse planétaire, naine blanche et enfin naine noire



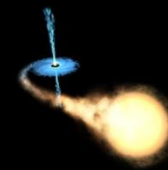
$M : > 6 \text{ à } 100 ? M_s$

$T^\circ = 30000^\circ\text{C}$

Durée de vie : Quelques millions à quelques dizaines de millions d'années

*Fin de vie :*

Peut passer par le stade de supergéantes rouges, puis supernova



Puis pulsar ou trou noir

Géantes bleues