

A vibrant blue nebula with a bright central star and scattered smaller stars.

# NEUTRON STARS

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# OVERVIEW

- Introduction
- Life of a star
- Formation of Neutron star
- pulsars
- Summary



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# Neutron star vs. Chicago

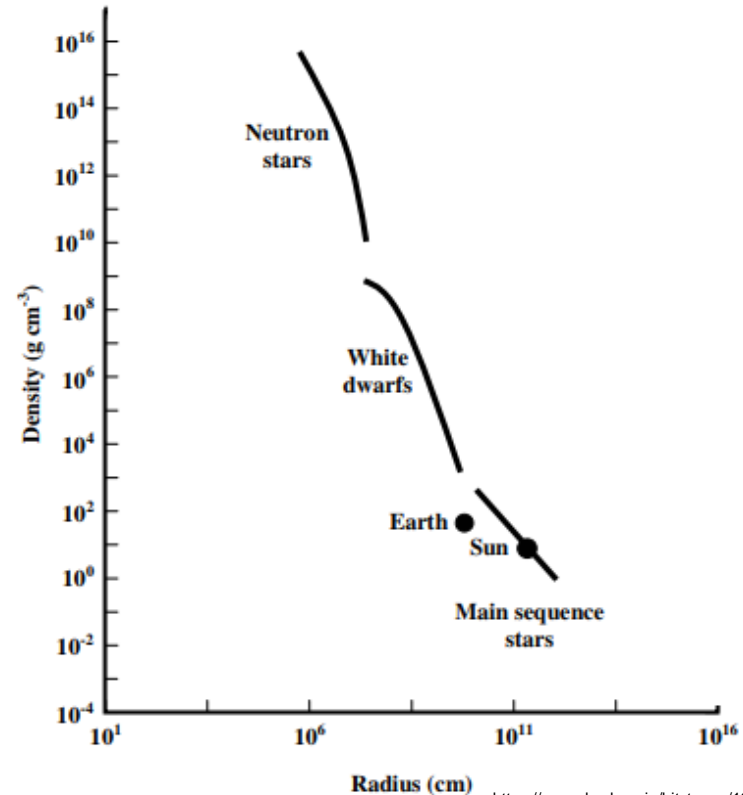


Mass =  $1.4 M_{\text{sun}}$ , Radius = 10 km  
 Spin rate up to 38,000 rpm  
 Density  $\sim 10^{14}$  g/cc, Magnetic field  $\sim 10^{12}$  Gauss

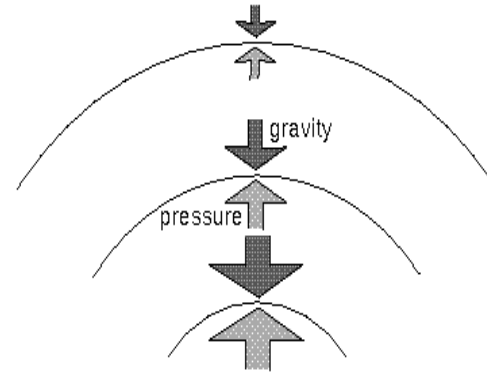
<https://www.astro.umd.edu/~miller/nstar.html>

# Introduction

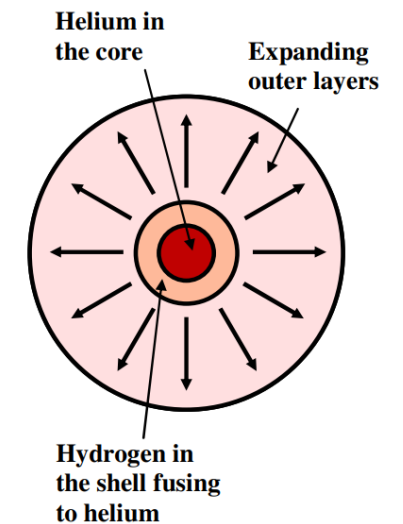
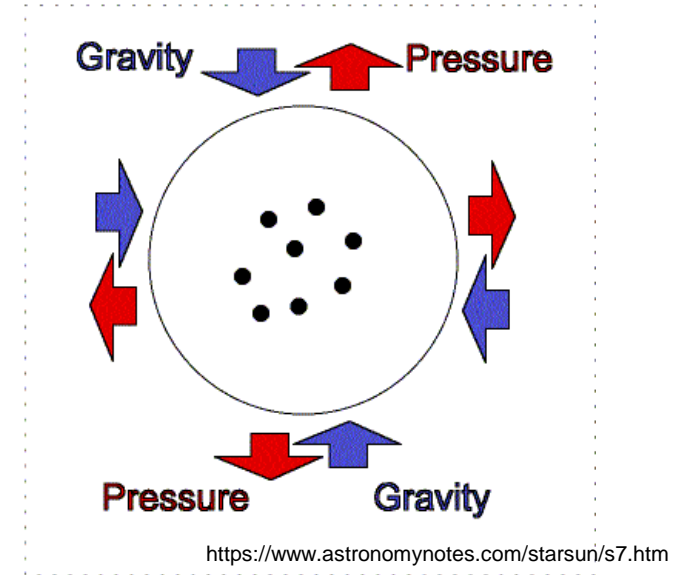
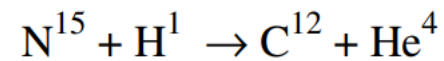
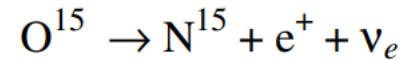
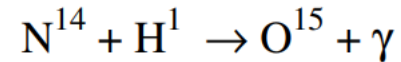
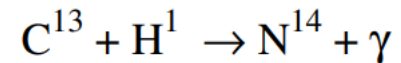
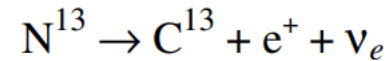
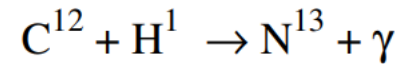
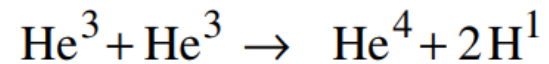
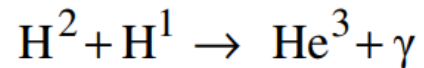
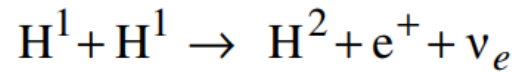
- Neutron stars are the collapsed cores of some massive stars.
- Theoretical prediction in 1934 by **Walter Baade and Fritz Zwicky**.
- Discovered by **Jocelyn Bell** in 1967.



# Life of a star



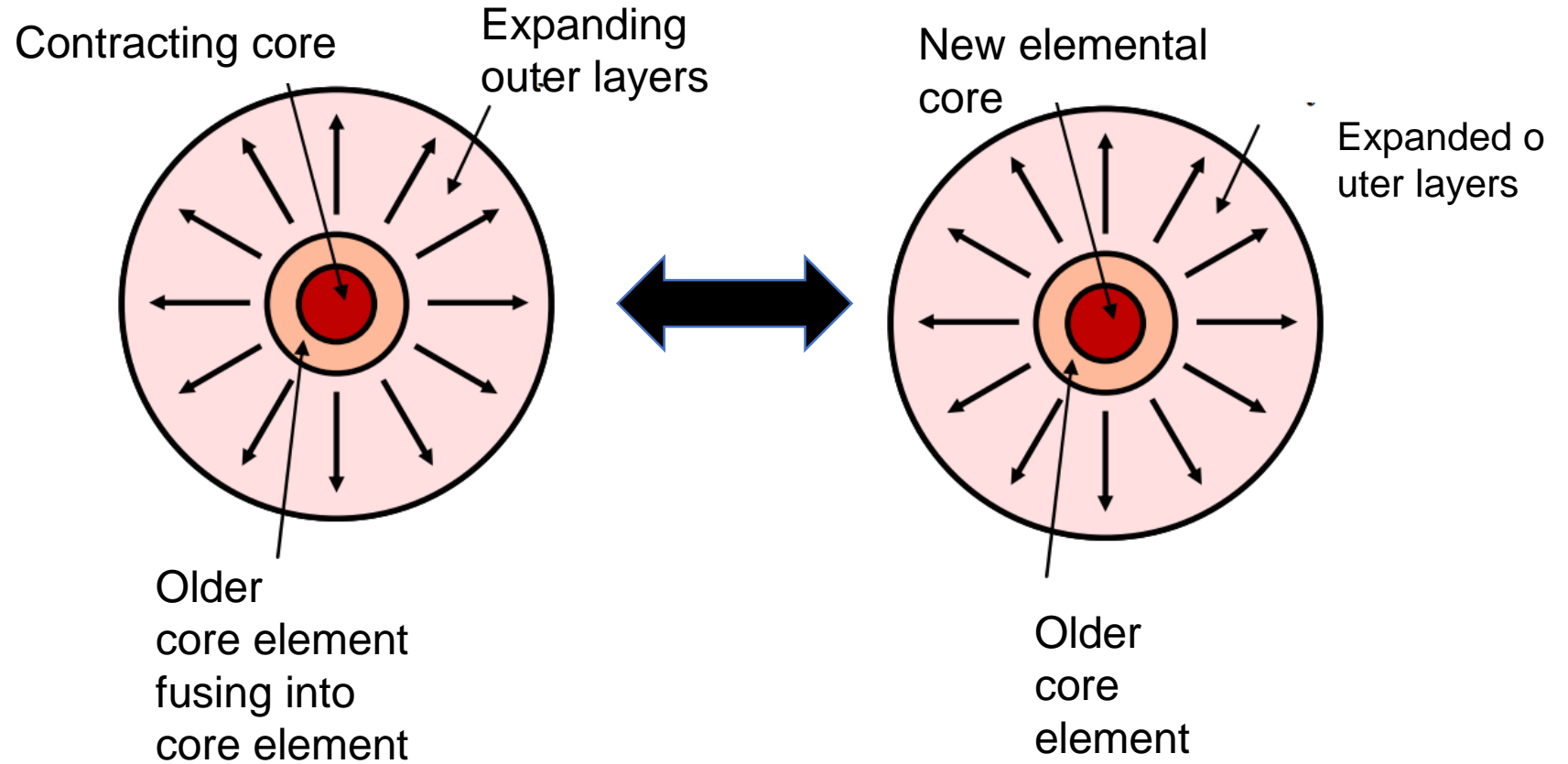
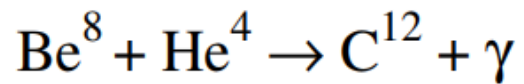
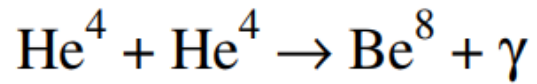
- Stars are made up of hydrogen and helium.
- Initial stages : Hydrogen burning



<https://egyankosh.ac.in/bitstream/123456789/19475/1/Unit-10.pdf>

LIFE OF STAR

Helium Burning :  
triple- $\alpha$  reaction



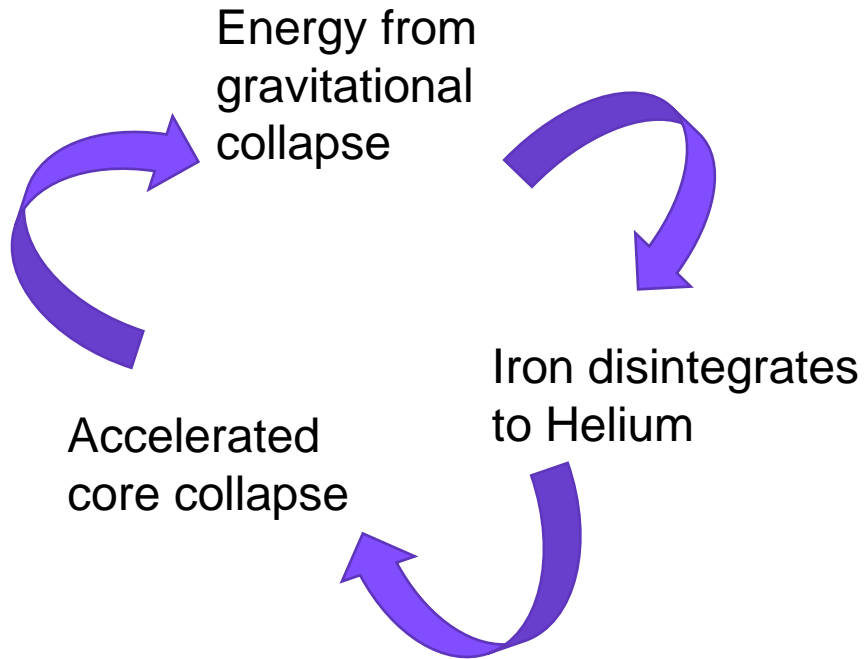
- This process Continues until the core is made of iron.

# Formation of Neutron stars

## FORMATION OF NEUTRON STARS

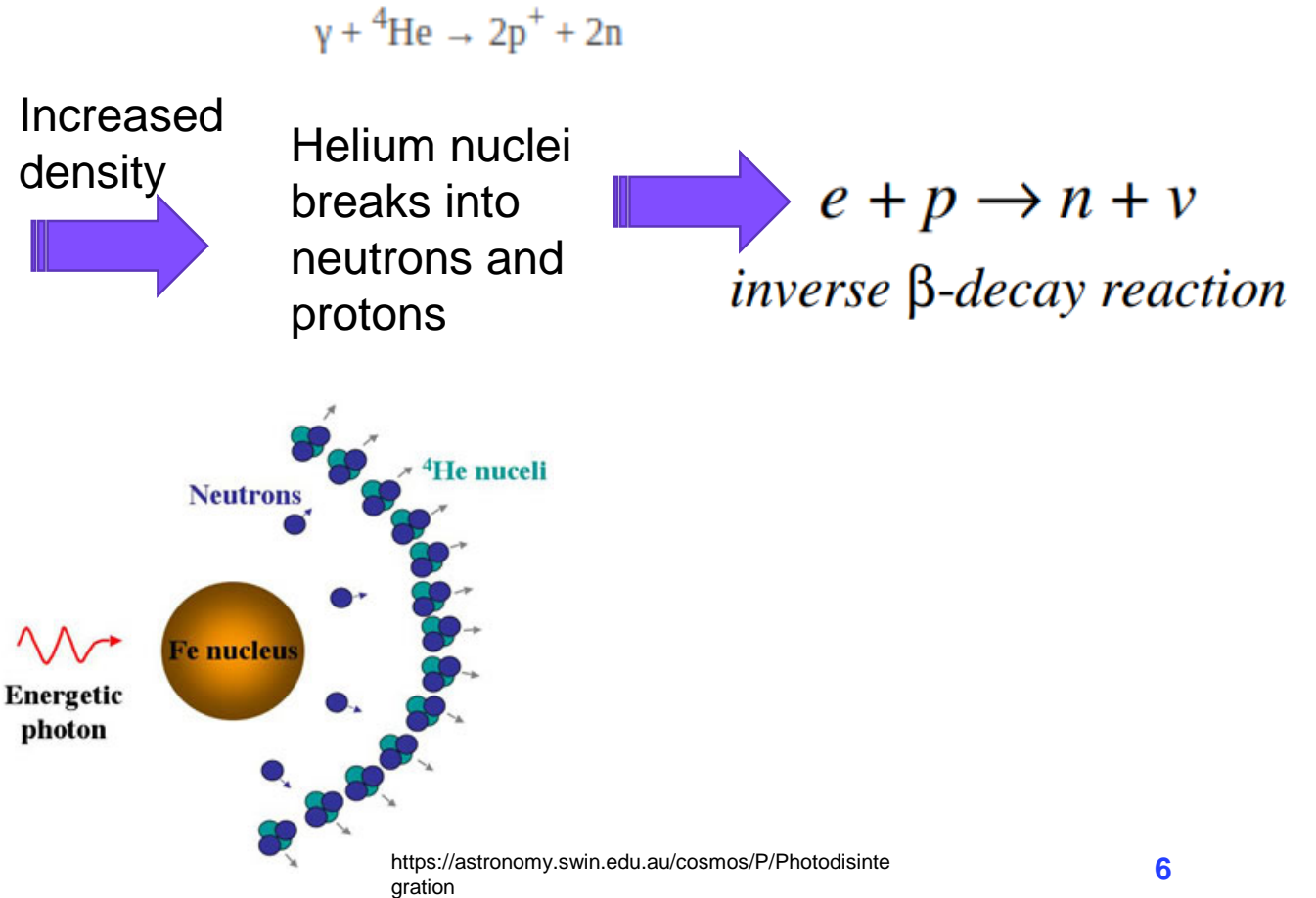
Iron has the high binding energy.

When mass of the star is between  $4M_{\odot}$ -  $8M_{\odot}$



### Photodisintegration :

is the disintegration of the iron by the intense light (electromagnetic) energy produced from the gravitational energy.

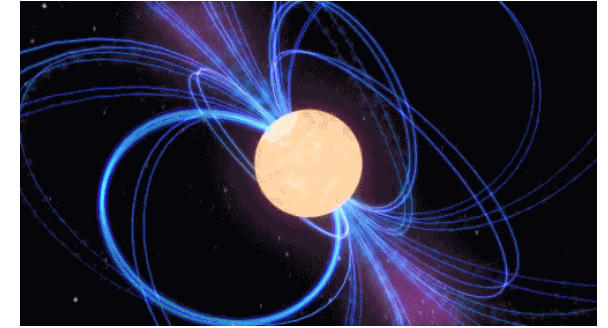


## FORMATION OF NEUTRON STAR

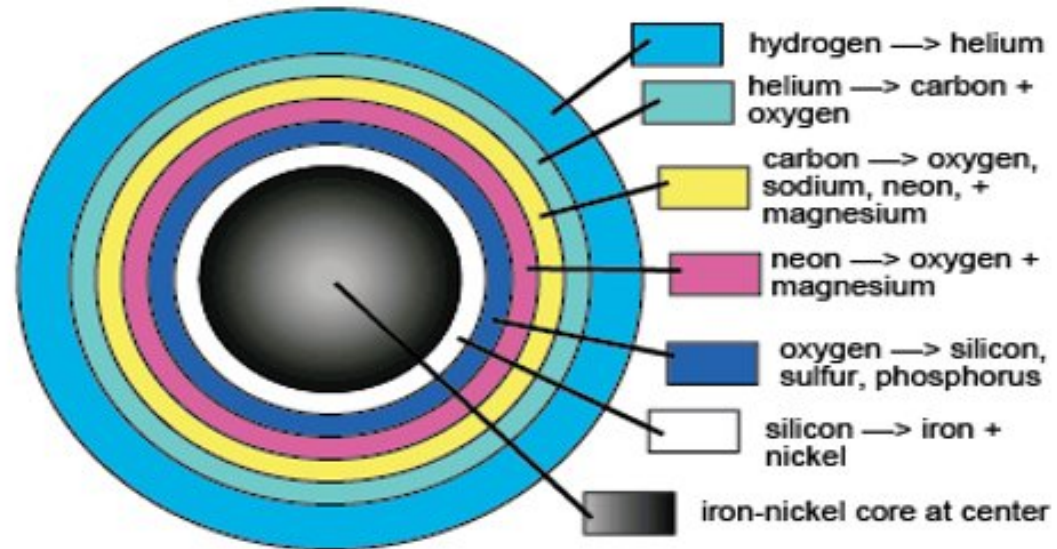
During this process large amount of energy transfer to envelope .



Nuclear reactions resulting into elements all the way to Iron and explodes to **supernova**



[connieleeann.tumblr.com](https://www.tumblr.com/connieleeann)

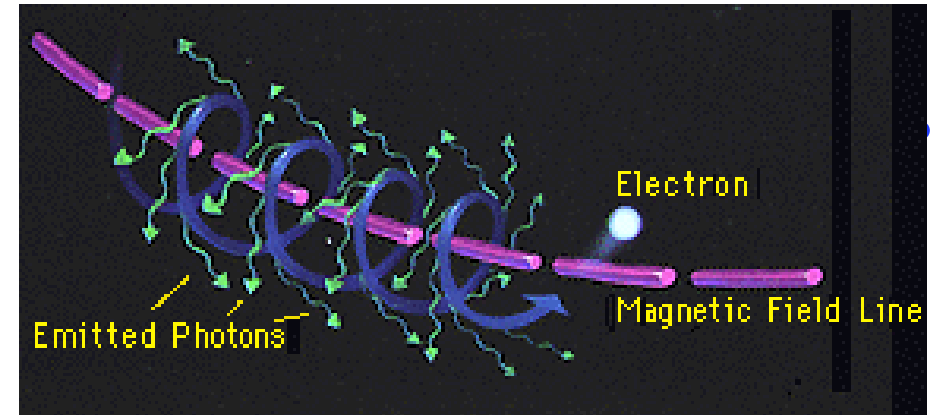


<https://www.astronomynotes.com>

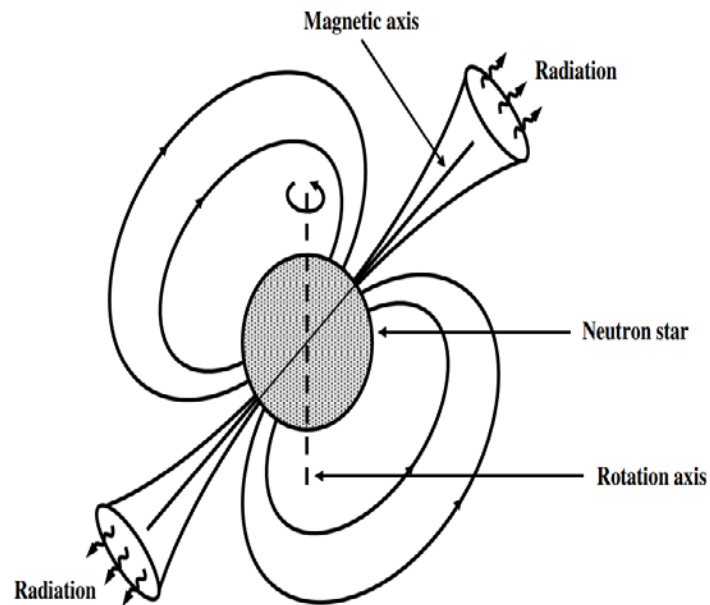
# Pulsars

Highly rotating neutron stars.

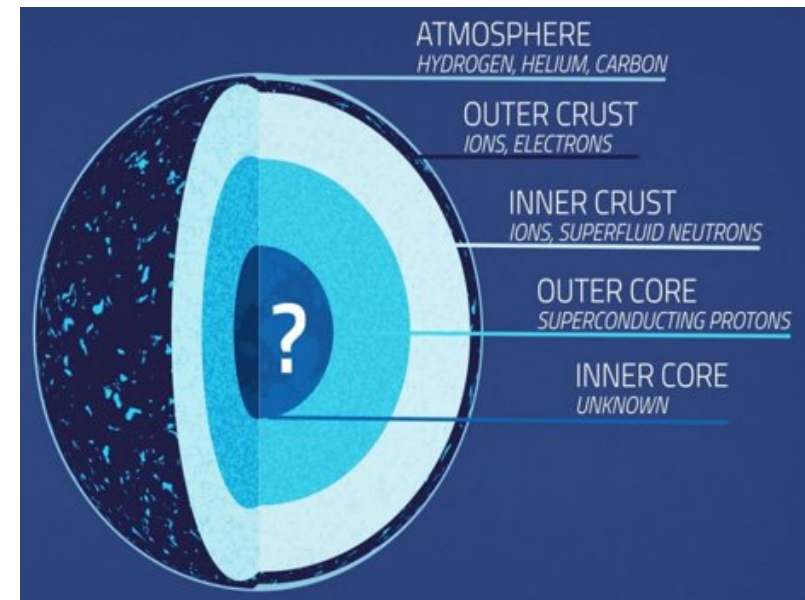
Synchrotron radiation : Synchrotron radiation is the **electromagnetic radiation emitted when charged particles travel in curved paths.**



[https://imagine.gsfc.nasa.gov/science/toolbox/xray\\_generation\\_el.html](https://imagine.gsfc.nasa.gov/science/toolbox/xray_generation_el.html)



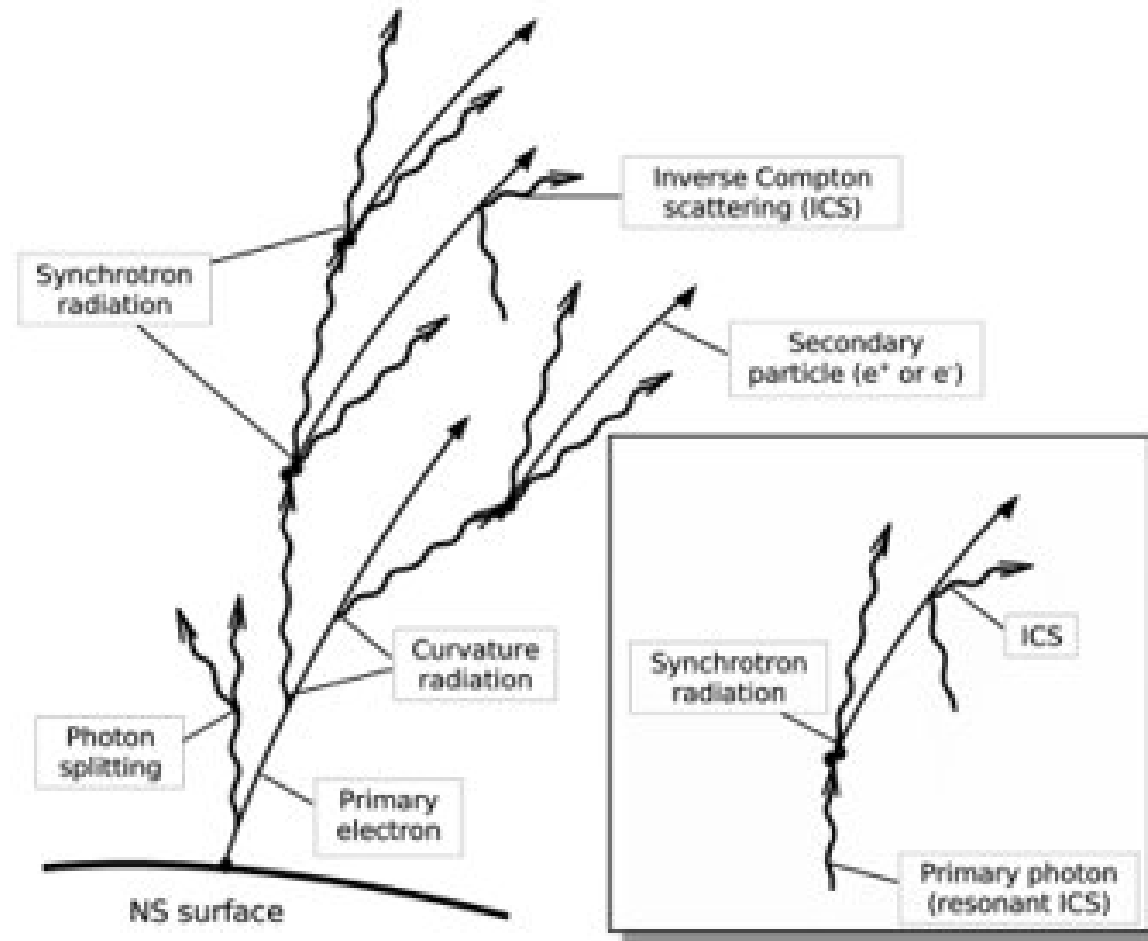
<https://egyankosh.ac.in/bitstream/123456789/19475/1/Unit-10.pdf>



<https://skyandtelescope.org/astronomy-news/whats-inside-neutron-stars/>



Lost energy is the rotational energy.



Electron positron cascade

# summary

- Neutron stars are the end product of stellar evolution.
- Gravitational collapse is the main cause for the formation of Neutron stars.
- Pulsars emit pulses due to synchrotron radiation

NEUTRON STARS

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THANK YOU