

# #100tífiques

*11 February 2021*

International Day of Women and Girls in Science

Talk by Dr Vanessa Graber

*@ Reial Monestir de Santa Isabel*

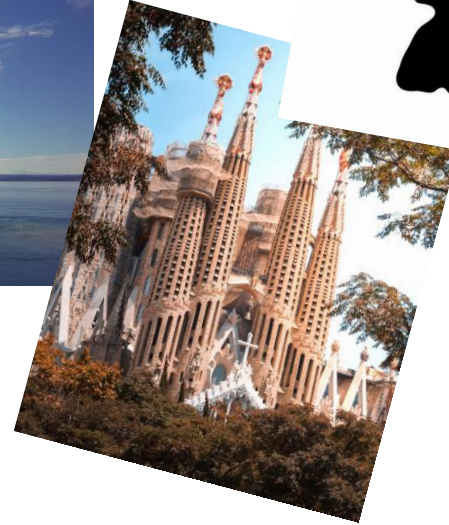


# #100tífiques

# Let me introduce myself



- I am originally from **Germany**.
- I moved to **Barcelona** about a year ago.



- I am an **astrophysicist**.
- I work at the **Institute of Space Sciences**.

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# Things I like to do ...

- Read **books** and listen to audiobooks.
- Play **board games** and solve crosswords.



- Do **Yoga** and enjoy **hiking**.
- Lots of **cooking** and **baking**.

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# When I was your age ...

- I did not know what kind of job I wanted, BUT ...



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# My path into science

- I did not have any scientists in my **family**.
- I had several science and maths **teachers** that made me **curious** about science.
- I did not know what being a scientist means.
- **BUT I REALLY LIKED:**
  - Solving problems
  - Asking lots of questions
  - Understanding how and why things work
  - Finding connections



**#100tífigues**



# What I love about being a scientist

See many new places

Think about  
questions we cannot  
answer (yet)

Use maths and  
programming to  
understand our  
Universe

BEING A SCIENTIST

Teach and  
talk about  
science

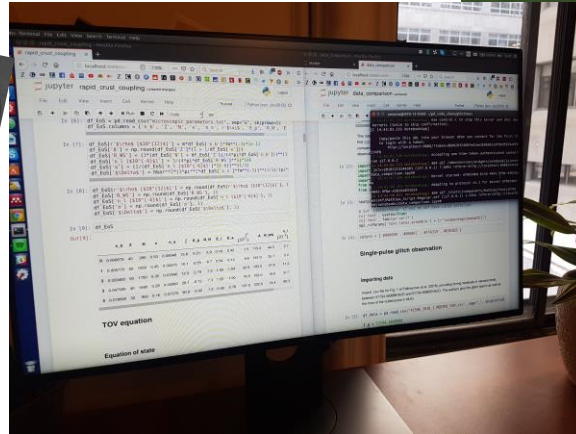
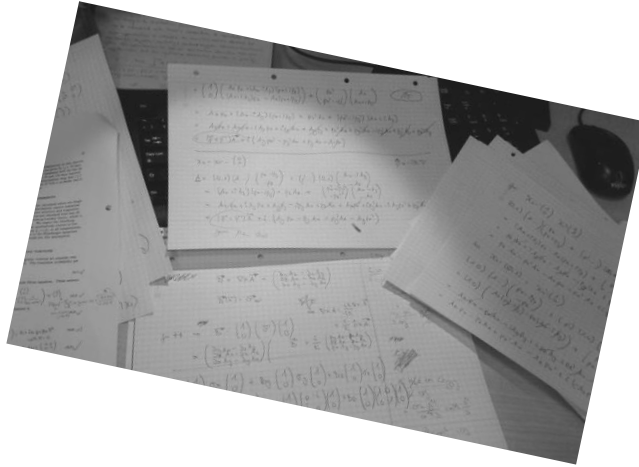
Work and meet  
people from all over  
the world

Learn something  
new every day

**#100tífiles**

# How do I work?

- I work at the Institute of Space Sciences.
- My day typically lasts from 9am to 6pm.
- I work with a computer, pen and paper.



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# How do I work?

- No one knows everything ... **working with others** is very important for scientists:
  - LOTS OF meetings to exchange ideas and solve problems.
  - Go to conferences to present work.
  - Write reports to share research.
- This is the **team** I currently work with:



#100tífigues



# My field of research

- I am an **astrophysicist** – a physicist who studies stars.
- I knew very little about **astrophysics** and **astronomy** before University.
- My field of research is one **specific type of star** ... a so-called ...

## NEUTRON STAR

- Neutron stars are **very different** to our own Sun.
- We **cannot see** them with our **own eyes**.
- They are **too far away** to take nice pictures.

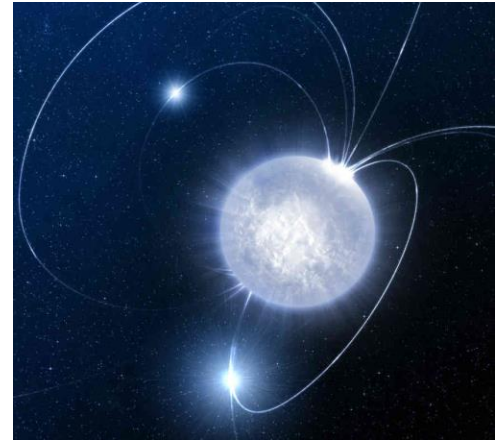
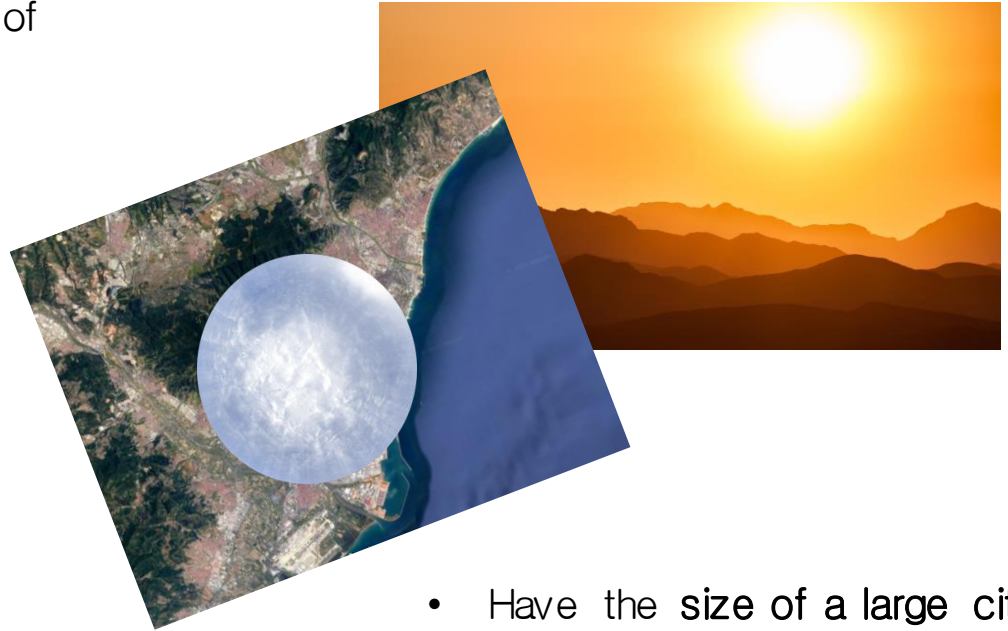


Image credit: ESO/L.Calçada

# Neutron stars - what are they?

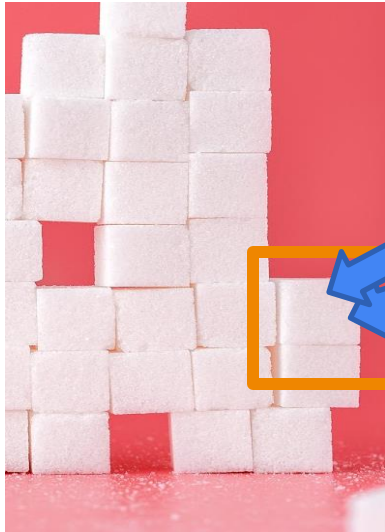
- Mainly made of neutrons, one of the **building blocks** of atoms.
- Look very much like a **sphere**.



- Have the **size** of a large city.
- **Weigh** as much as our Sun.

# Neutron stars - what are they?

- Denser than anything we have on Earth.
- Densest objects in the Universe.



- Because of that we do not know what is going on inside of neutron stars.

# Neutron stars - how do they form?

- Formed in **explosion** of very massive stars.
- One neutron star is made about **every 100 years**.

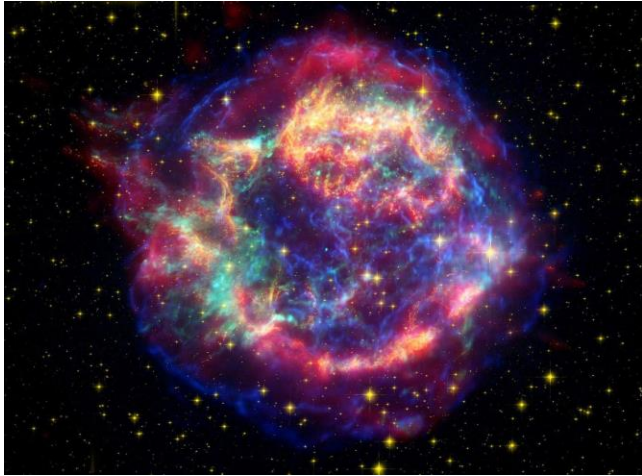


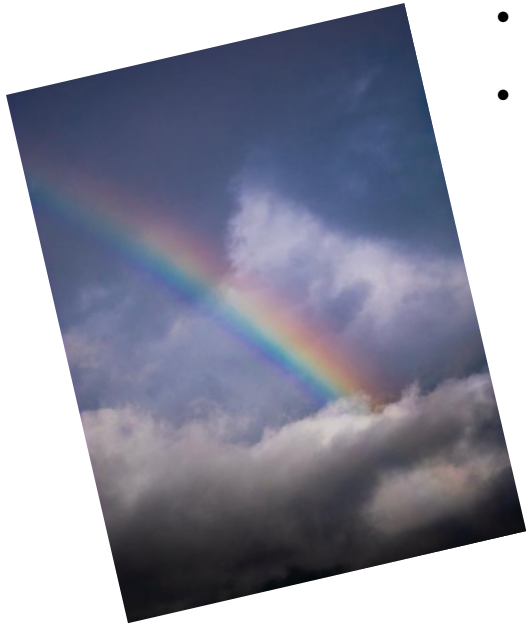
Image credit: NASA, JPL-Caltech, STScI, CXC, SAO

Image credit: NASA, ESA,  
J. Hester, A. Loll (ASU)

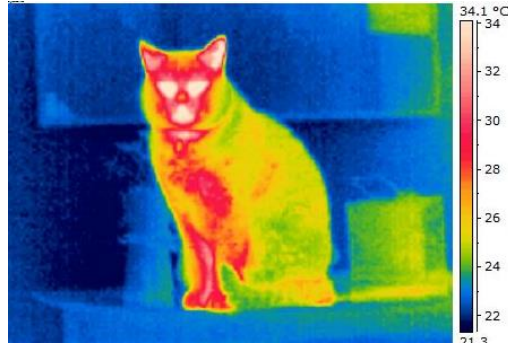


- Using telescopes, we can see what is left over from the explosion: **supernova remnants**.

# Neutron stars - how do we observe them?



- Human eyes can only see visible light.
- That is a small part of the electromagnetic spectrum.



- With **special devices** such as glasses, scanners or telescopes, we can see different types of radiation.



# Neutron stars - how do we observe them?

- Neutron stars were first observed with radio telescopes in 1967.

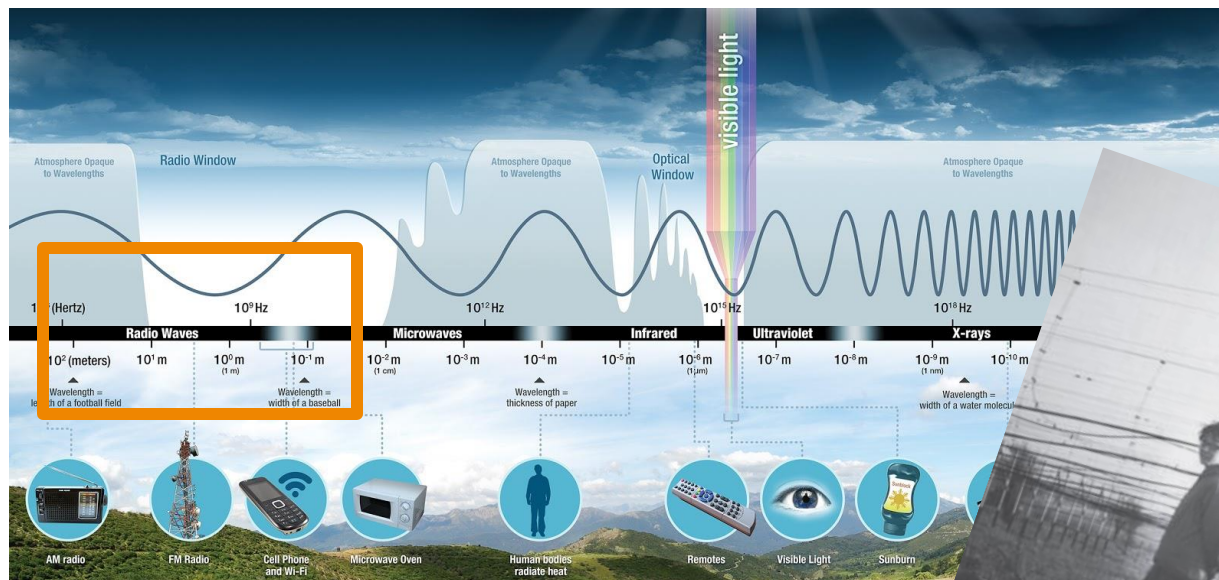


Image credit: NASA

# Neutron stars - why we observe them?

- Neutron stars have very strong magnetic fields and rotate fast.
- Because of that, they emit a radio beam like a light house.

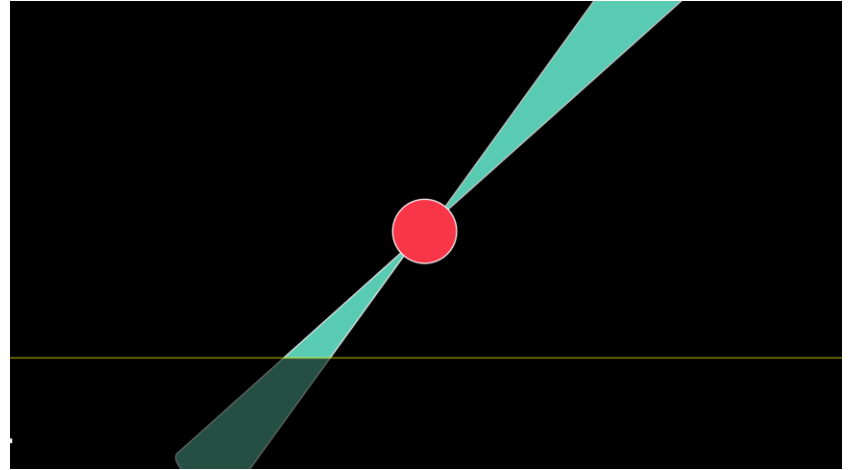
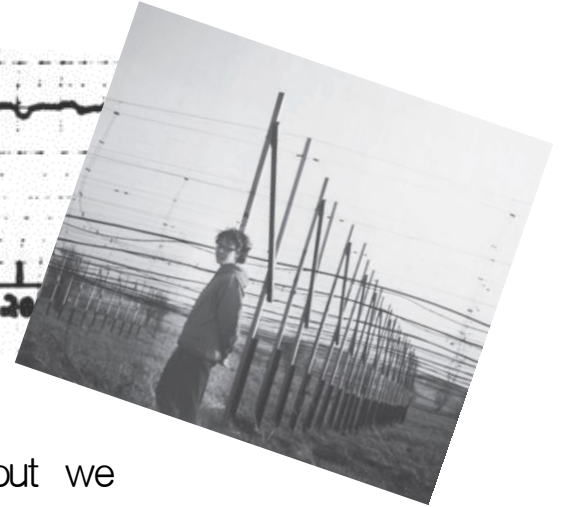
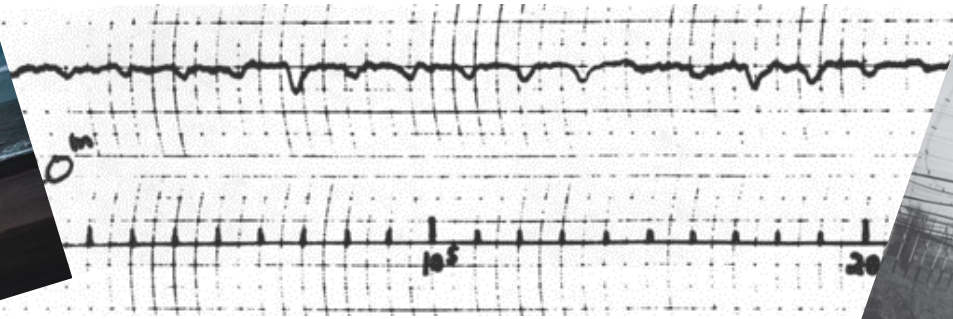


Image credit: J. Christiansen

# Neutron stars and their pulses

- Observe these pulses with radio telescopes – we know of about 3000 pulsars.



- We cannot look inside neutron stars, but we can **analyse the pulses** to learn more about them.
- Measure **distance** between **pulses** to follow **spin frequency**.

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# Neutron stars - a little experiment

- We can use a **cooked** and a **raw egg** for a little experiment:



- **Cooked egg** – shell, egg white and yolk are all connected and move together
- **Raw egg** – shell is not connected to the egg white and yolk; they move independently



# Neutron stars - looking into their interiors

- For neutron stars, we do **not** have a **huge finger** stopping the star but **other mechanisms** with similar effects.



Image credit: ESO/L.Calçada

- Neutron stars are like the **raw egg**: they have a **fluid interior**.
- I use **mathematics** to **predict** how this fluid behaves and my theories are then **compared to observations**.

**#100tíques**





BEING A SCIENTIST IS  
LIKE SOLVING PUZZLES  
BUT VERY OFTEN WE DO NOT  
KNOW THE PICTURE THAT  
WE ARE TRYING TO PUT TOGETHER.



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