# Star Parties

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# Justification

- This material is designed for teachers of children before starting primary school. Some content is presented to give the teacher more resources, although they may be too ambitious for such young children, but the questions that they may sometimes ask require more extensive knowledge to be able to properly explain the issues that may arise.

# Goals

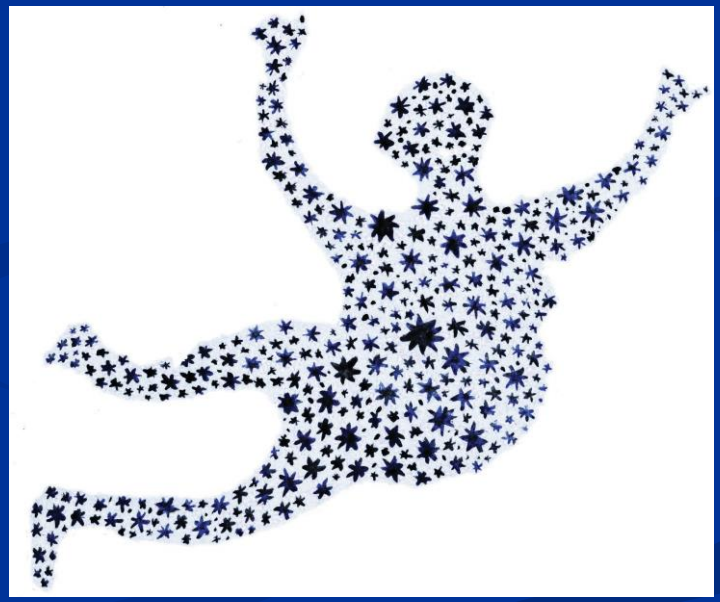
- Understanding stellar evolution.
- Understand the different types of stars.
- Understand the appearance of the heaviest materials inside stars

# Method

- The Matylda story is used, which must be adapted to the age of the students.
- The narrative includes concepts about the birth, development and end of the stars, as well as the formation of the elements necessary for life.
- The following slides highlight the paragraphs of the story with scientific concepts.
- Before starting the session with the ppt, it is advisable that the participants read the story with enough time.

Once upon a time a bright and luminous cloud…. of interstellar gas and dust…was found between the stars.

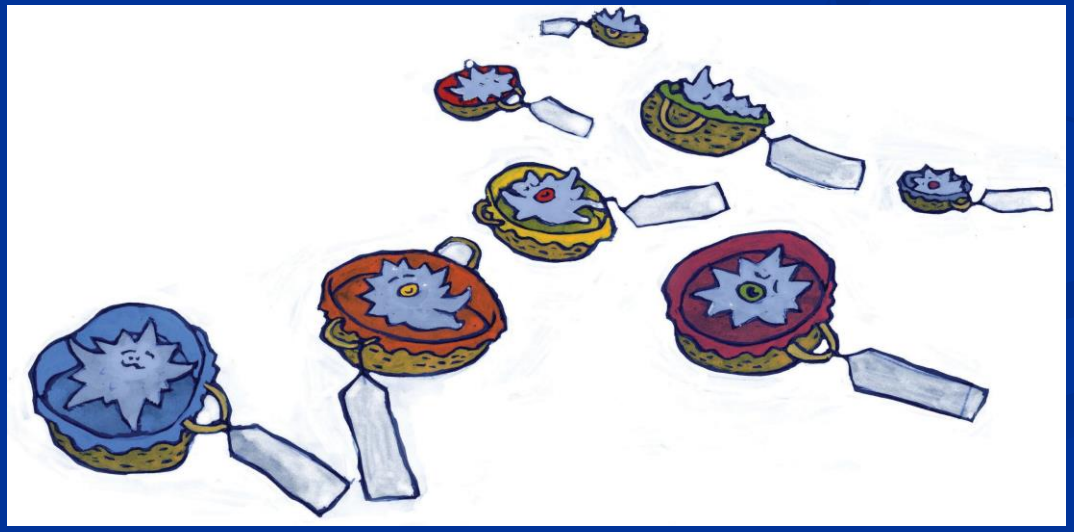
It was a hot cloud… because the dust particles that formed it were organizing a party and were running around playing…. between the crashes that occurred and all the running... the atmosphere became increasingly hotter and hotter.



… stars are similar to children, they form in their mother's belly, the cloud of interstellar gas and dust, and then they are born and grow, and become older. But since the clouds of bright gas and dust are very large, instead of 1, 2 or 3 stars being born, as happens with children, hundreds of stars are born at the same time…

…the particles and specks of dust have been running for thousands of years, and after many collisions and agitation they remain embraced and so stuck to each other that little by little they form stars.

The party ends when these stars begin to be born, but the truth is that they take hundreds of thousands of years to fully form….



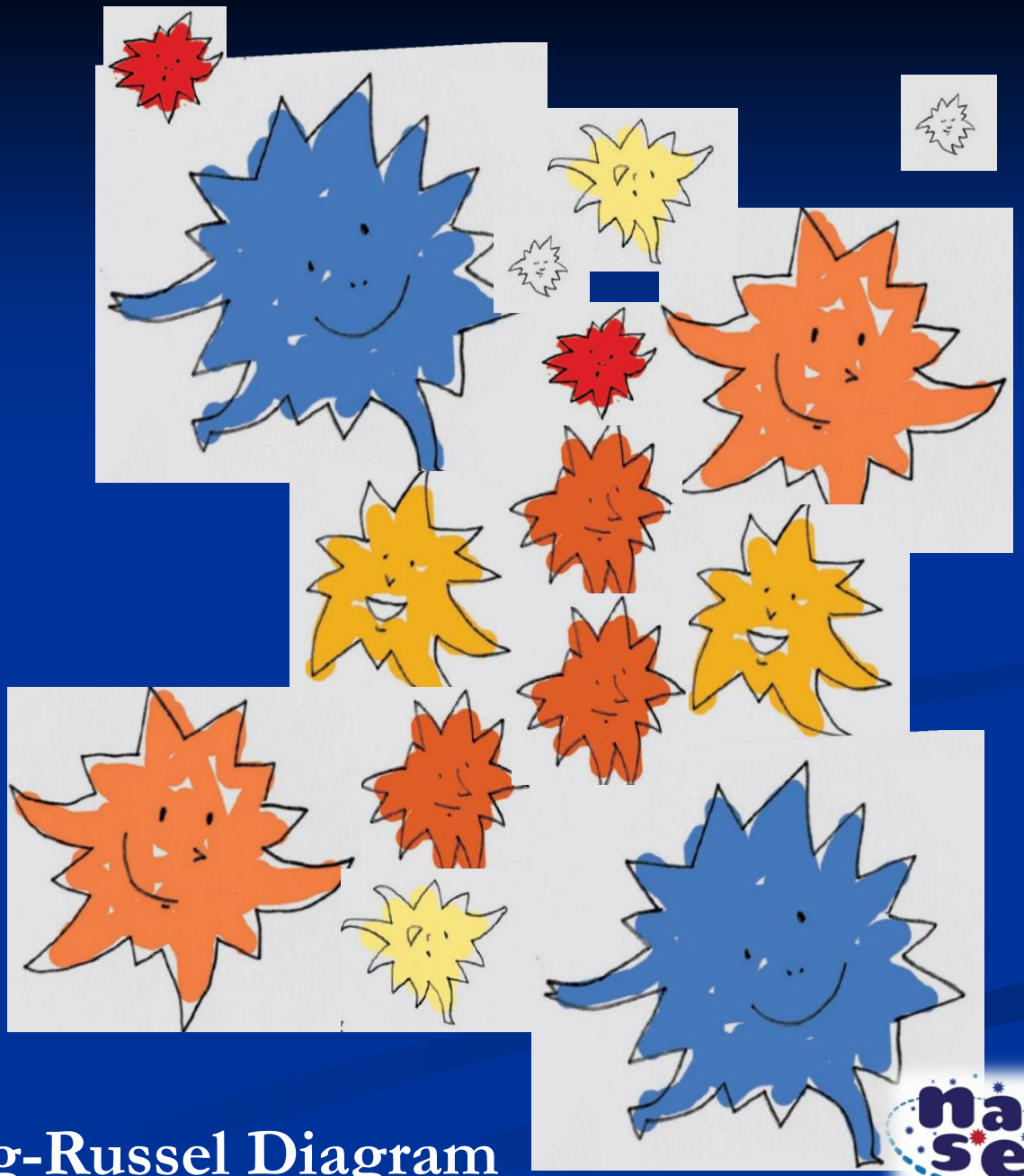
Some of these bright and beautiful reddish clouds, mothers of so many stars, can be seen in the sky at night.

In the cloud of our history there were 683 stars, all of them sisters and daughters of the same mother.

Not all the stars are the same, but we are going to follow the life of one of them...she herself has already decided what her name is going to be: Matylda with “Y”.

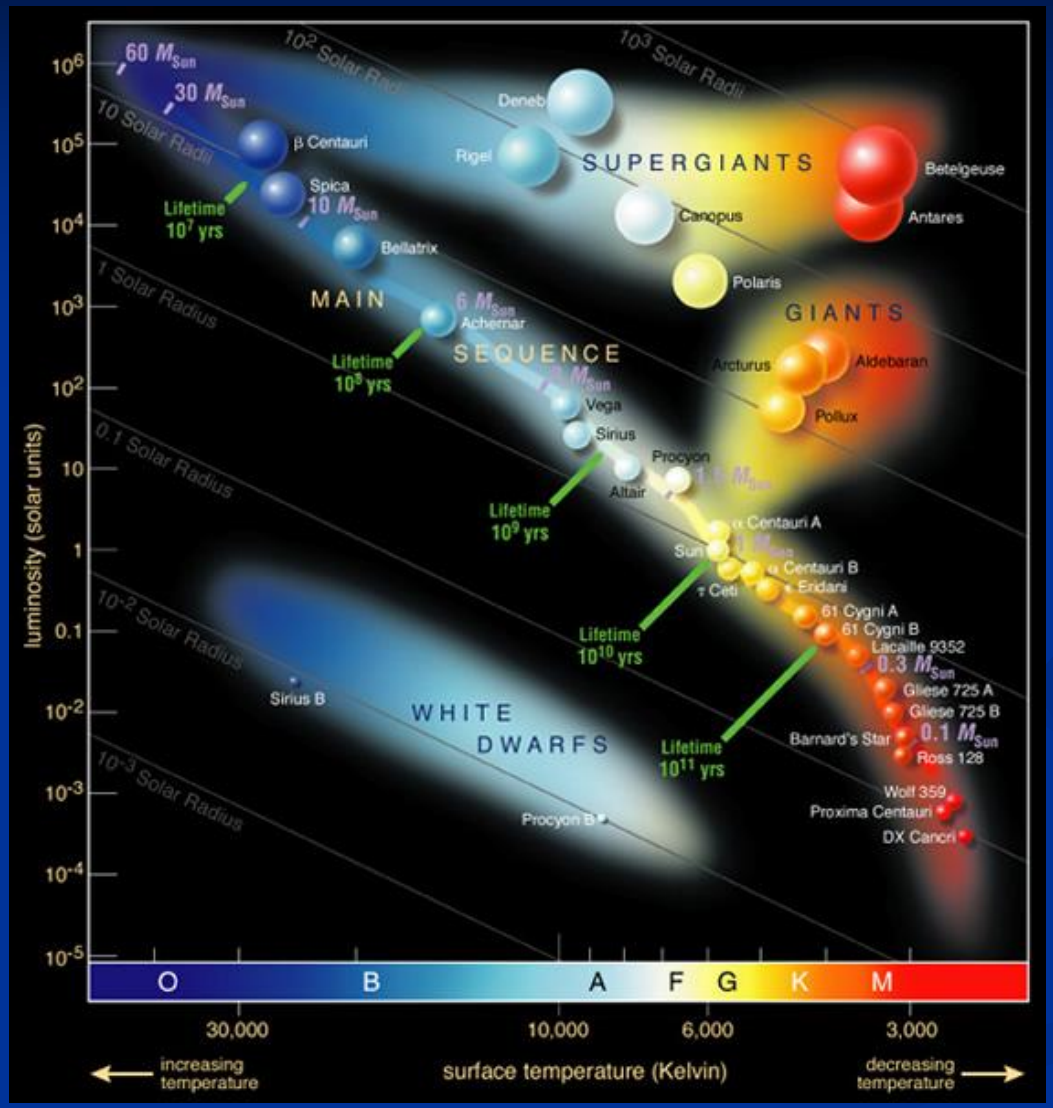
I am a yellowish white star. Stars have different colors that depend on the temperature. The hottest and largest are born in blue or white colors.

If we are more normal and average like me, we are born somewhat colder and yellow in color.



Hertzprung-Russel Diagram

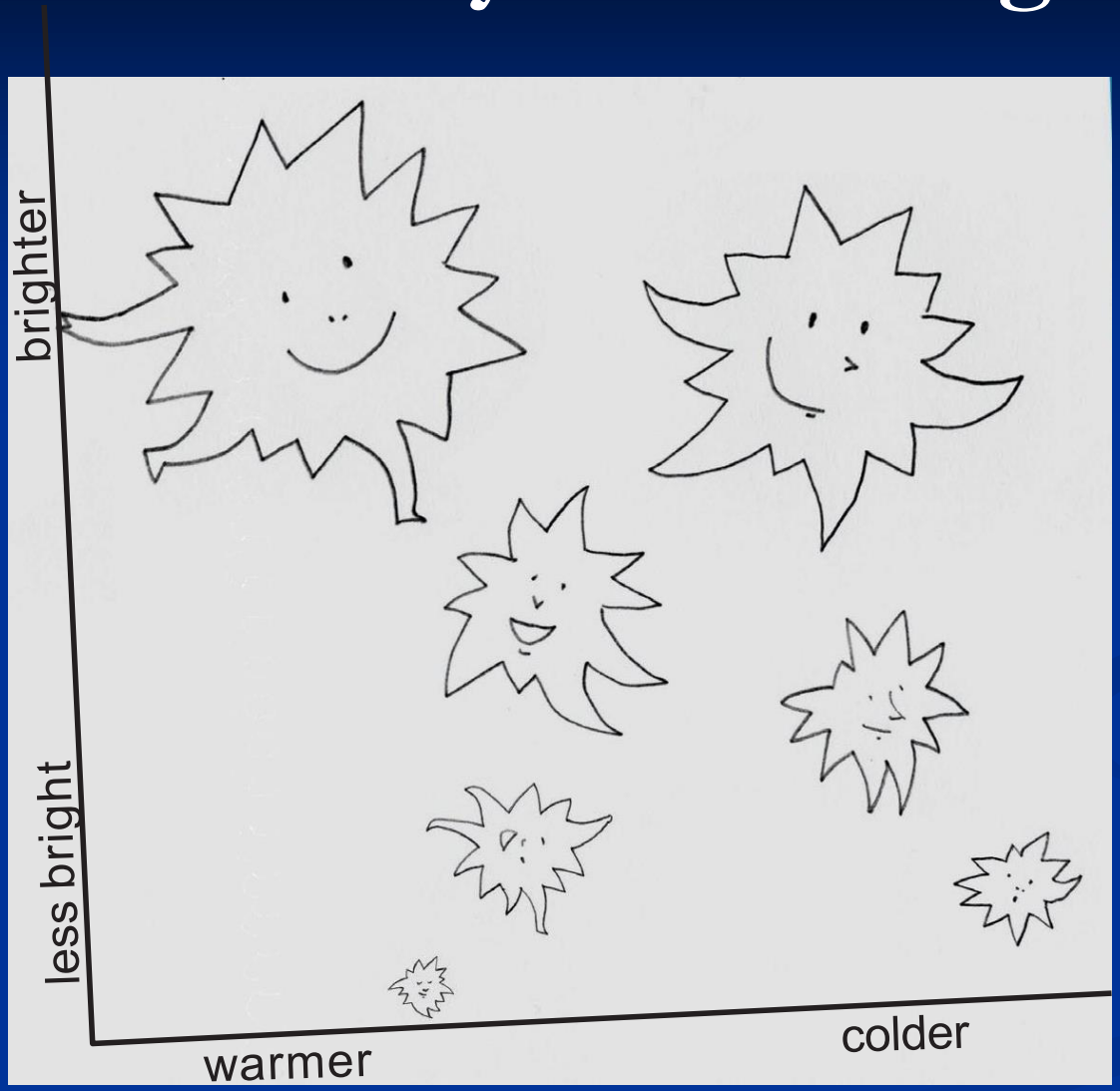
# Activity 1: HR Diagram model




(Credit: Enrique F Borja)

**Hertzprung Rusell Diagram to summarize stellar evolution**

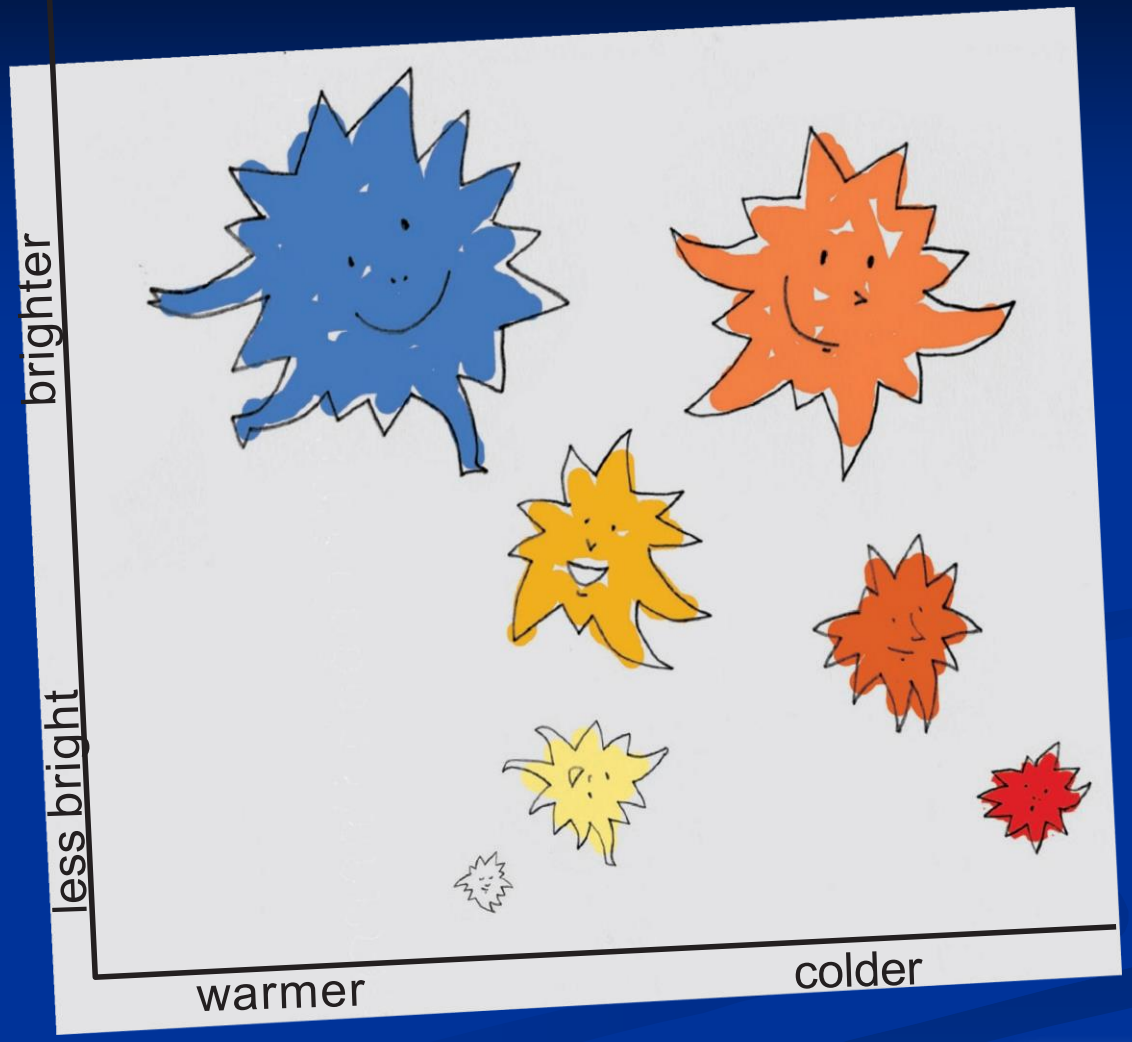
# Activity 1: HR Diagram model




**HR Diagram to color following Matylda's story**

# Activity 1: HR Diagram model

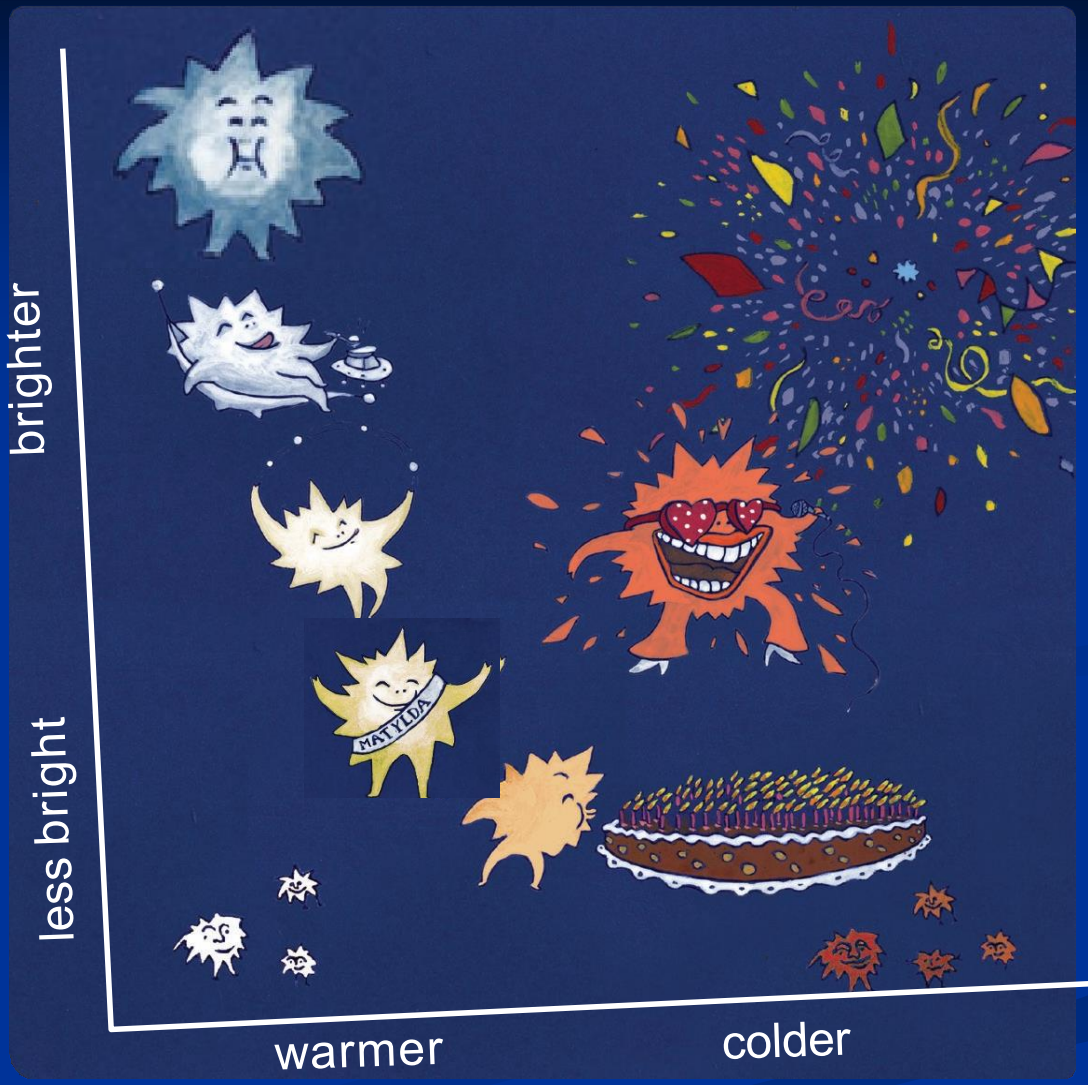
**HR Diagram colored solution**



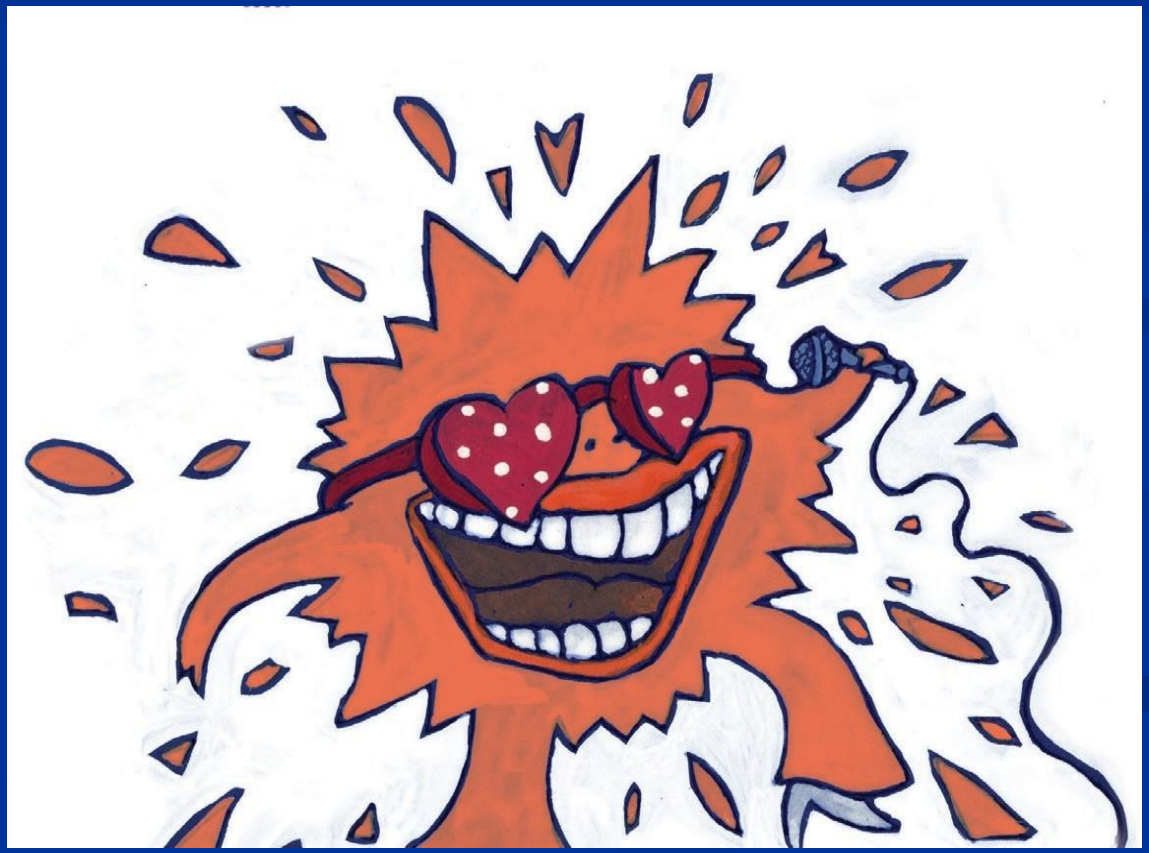

## Hertzprung-Russel Diagram

Almost all of our lives, we stars are quietly eating hydrogen and creating other heavier materials inside us.

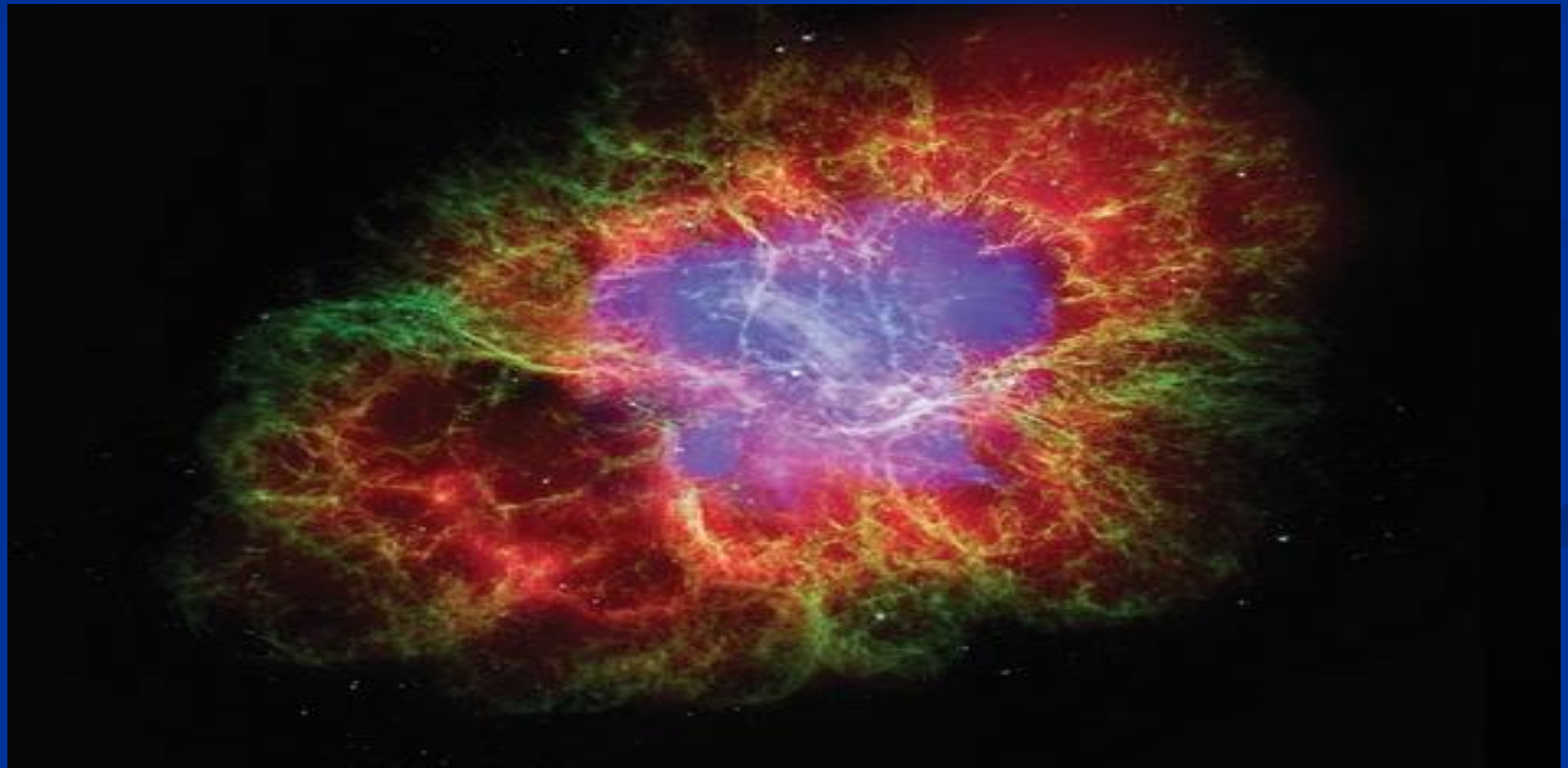
It's a great life. They call that being in the "main sequence."



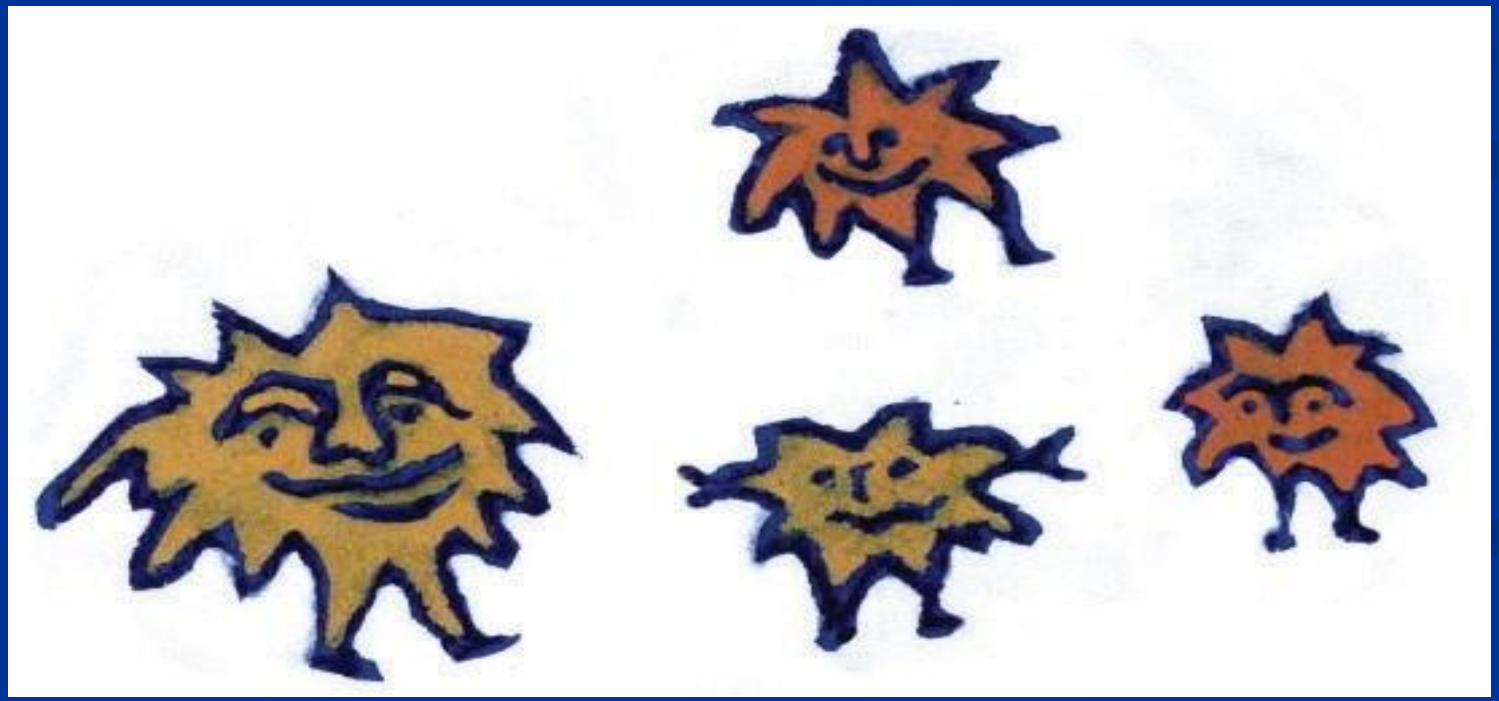
Later, when I have eaten almost all my hydrogen…. I will prepare to organize my big party…. with a lot of stress...with stress we swell and become huge and we get cold and become red.

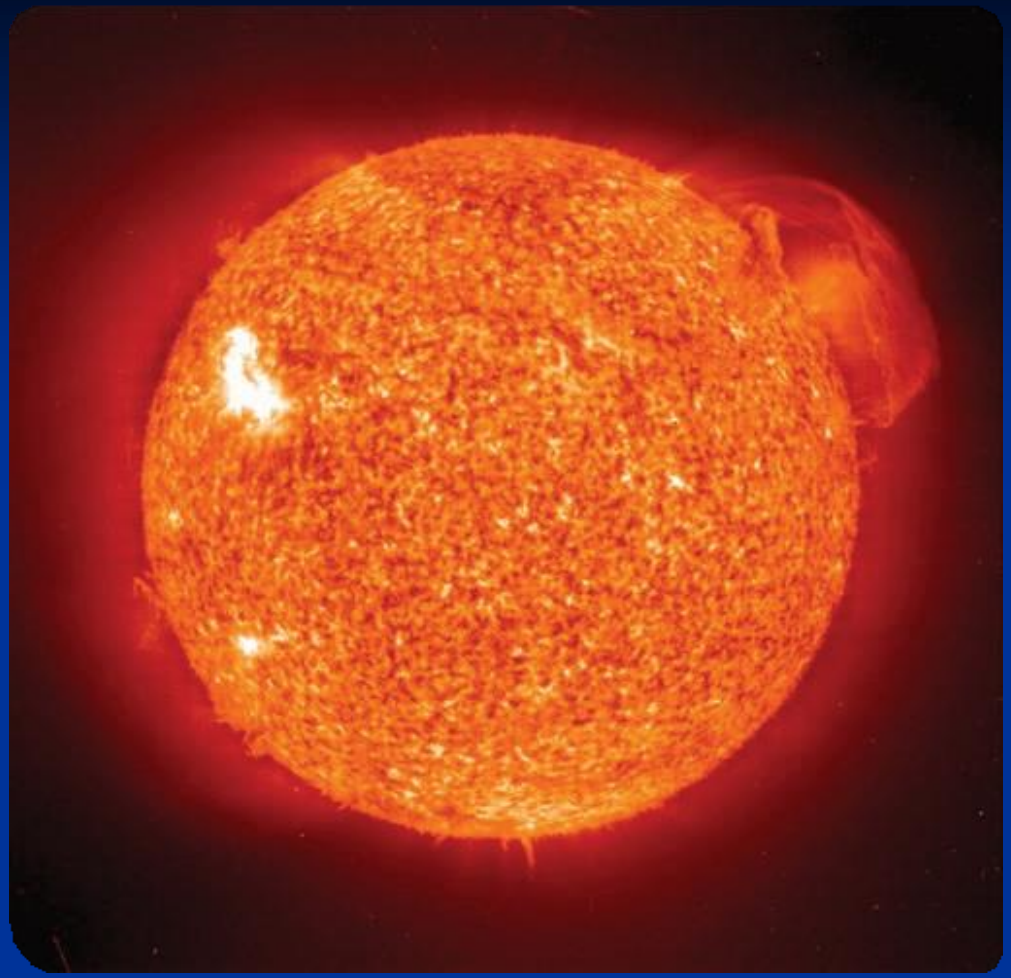


The smallest stars live many more years than the largest ones, which live less, just as gossip says, "the big ones live fast", but yes, when they are older they "swell up" like red supergiants and throw incredible supernova parties.



The little stars go more unnoticed... these stars are called black dwarfs because they are small and do not produce light. They gradually wither until they become cold and invisible in the universe….






I, Matylda, am a medium star when I grow up I will also turn orange and I will be a giant, but not very big,….

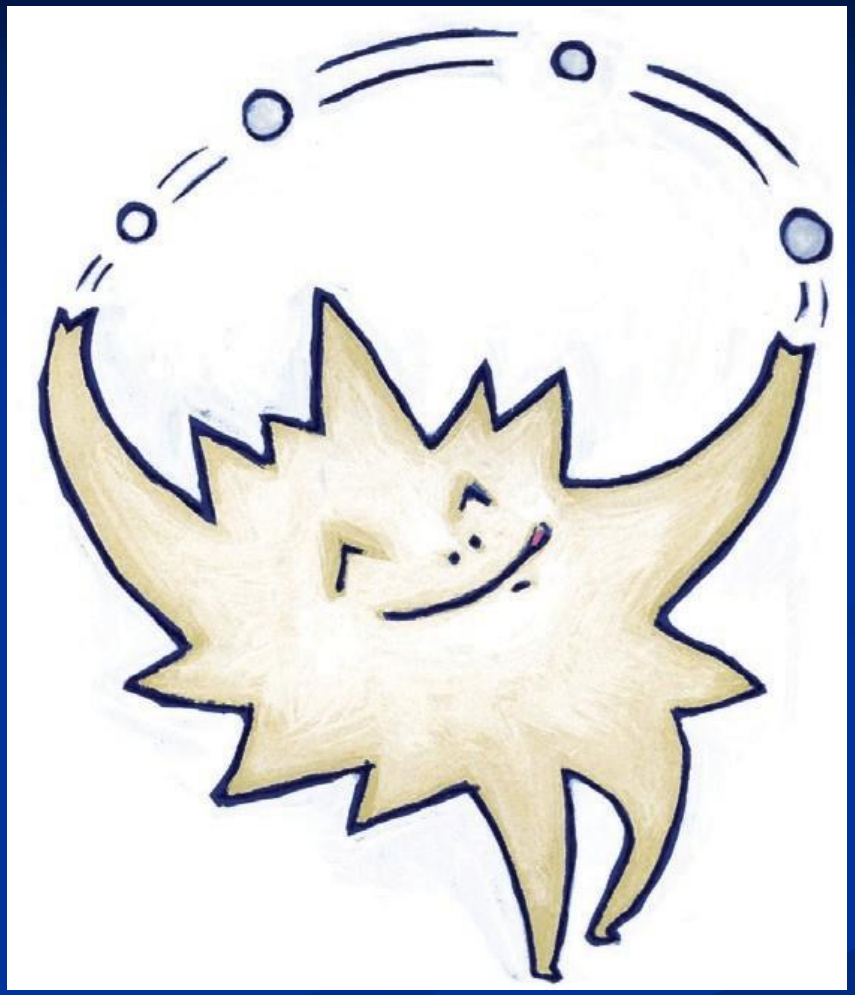
….at this time I am still in the clinic's “nursery”. I am with all my sisters at my side and with remains of interstellar dust between us.

…with the remains of material that I have so close and that when I spin around dancing around myself, it follows me like a ruffled skirt, I think I am going to form my planetary system.

…. this takes tens of millions of years to make... so there is no rush!...

… quite a few million years have passed. Now I am a yellow star. I'm hotter than before. Yes, just like the Sun…

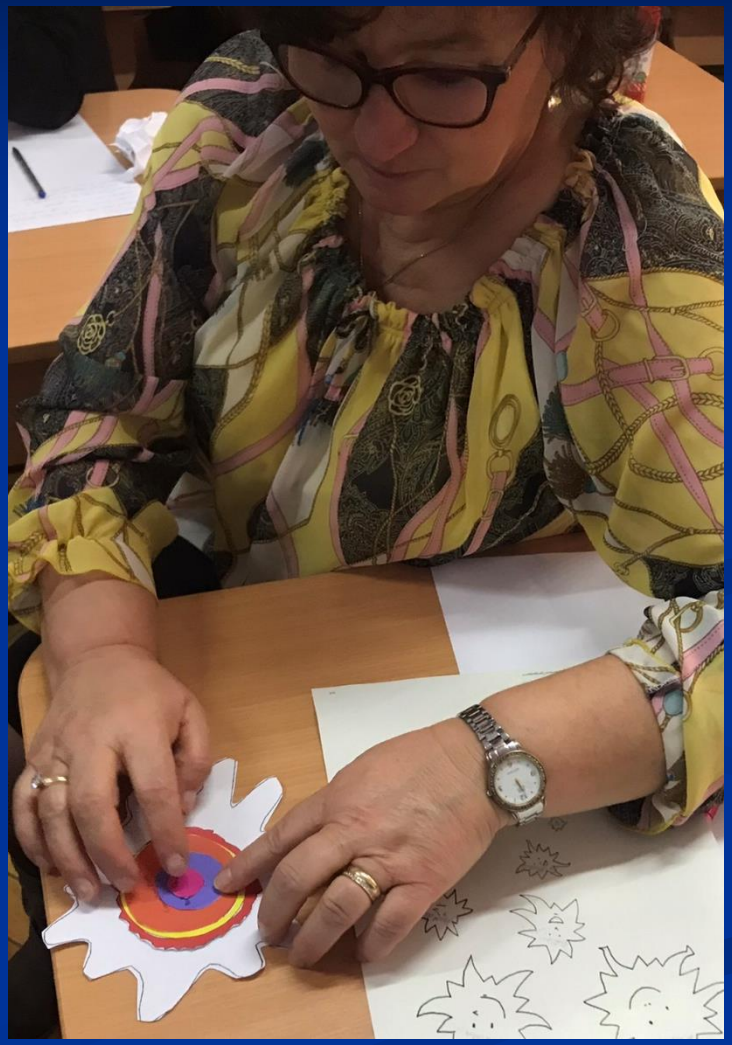
I already have my own planetary system…I love going with them everywhere, revolving around me. It's like juggling with friends. ….



For now there are none of them that are inhabited, but the appearance of life takes a long time to evolve, so it may be that in a few years things will change. …..

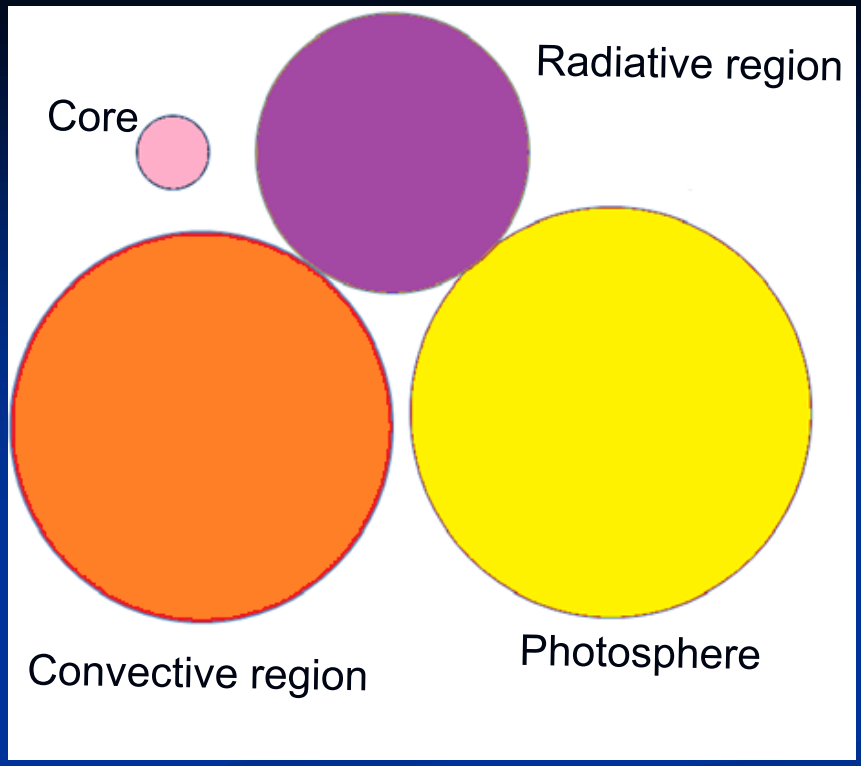
# Activity 2: Model layers of the un

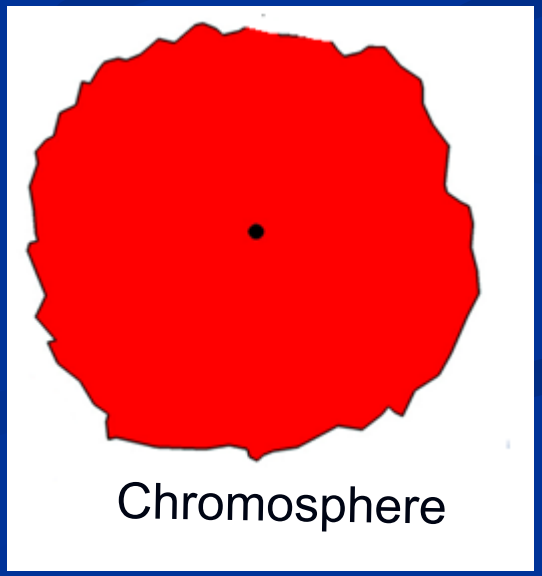
… the truth is that stars grow differently than children … it is as if we grew from the inside. When I was born I was a ball of hydrogen and helium, … in the universe almost everything is hydrogen, ….we form oxygen, carbon, nitrogen…..



# Activity 2:
# Model layers of the Sun

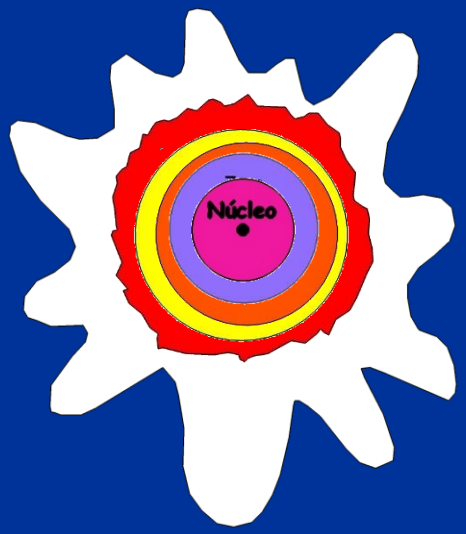
Simple layered model of the Sun. The objective is to cut out the different figures. They can be cut from different colored papers or painted.

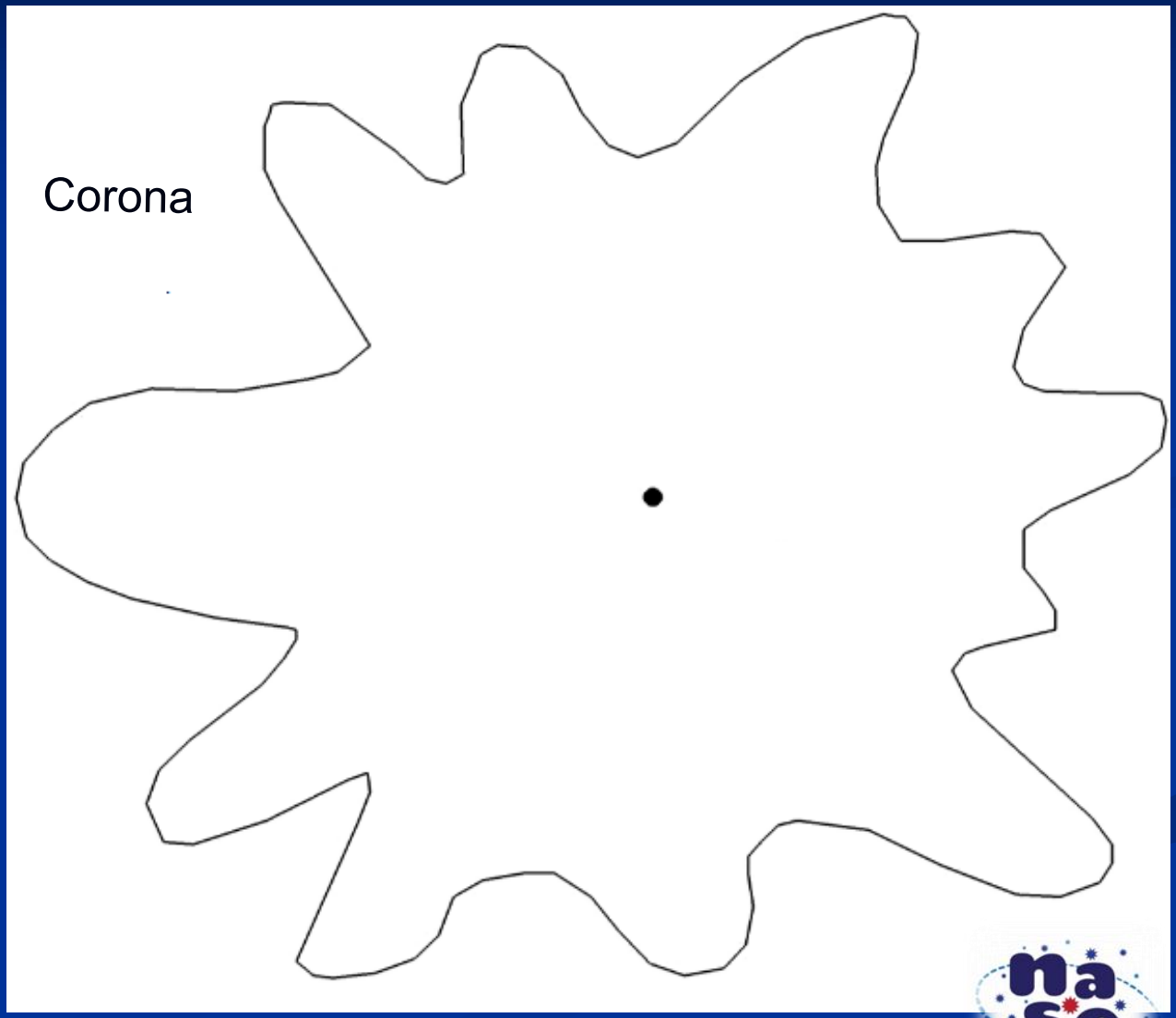


# Activity 2: Model layers of the Sun

**Finally, they are glued one on top of the other, in the correct order.**



….. water is formed with hydrogen and oxygen… the molecules that give rise to life on Earth are basically made up of carbon. A carbon that was born in the belly of a star. So we are very important for life, we are fundamental.

…my life is very relaxed, like that of the Sun, which is also a medium star. ….. I hope to live about 10,000 million years eating hydrogen and manufacturing increasingly heavier elements in my belly and I will slowly cool down… very, very slowly…

# Activity 3: Matchbox Model (spectroscope)

- To visualize the spectrum of sunlight and thus be able to know its composition
- To find out what stars are made of

# Activity 3: Matchbox Model (spectroscope)

- Paint the inside of the box black.
- Make a cross section to look at the spectrum inside the box.
- Glue a piece of CD to the bottom of the inside of the case (engraved area facing up).

# Activity 3: Matchbox Model (spectroscope)

Close the box leaving only a slit open in the opposite area of the viewer.

- Use the spectroscope with sunlight to see the solar spectrum.
- Can also be used with classroom lights

...as I generate so much energy inside I send bubbles of hot gas outwards, as they say, by convection...this means that, more or less, the heat comes out in the same way as it does when boiling a pot of milk. The particles at the bottom rise up through the center and then move a little towards the edge and down towards the bottom to rise again up through the center….

# Activity 4: Cake Model

To simulate the convection inside the Sun we can make a cake with chocolate so that we can visualize the movement of the chocolate inside the cake.

# Activity 4: Cake model

## Ingredients:

3 eggs

1 yogurt

1 glass of oil yogurt

3 glasses of sugar yogurt

4 glasses of flour yogurt

1 sachet of yeast

1 glass of powdered chocolate yogurt

A round mold

## Procedure:

Oven at 180º or 200º

Mix all the ingredients except the chocolate powder until you have a homogeneous dough.

Pour half of the mixture into the mold, then add the cocoa powder and then carefully finish pouring the mixture

Bake in the preheated oven 45 min

Remove from the oven and let it cool.

# Activity 4: Cake model

## Procedure:

We can see the chocolate lines inside the cake that go from the center to the edges

As the cake dough heats up, convection has begun and the dough has risen in the center and moved towards the edges in a circular movement that can be seen leaving the cocoa in the photo.

…eventually, I will use up almost all of my hydrogen and then I will swell up and…be so big that everyone will call me a red giant. …. I will start burning my helium to convert it into carbon and oxygen… and prepare a big birthday party to celebrate having spent so many years forming new elements in my belly and "boiling the milk" on the surface. The 10 billion year birthday must be very special!!

…since I don't have enough matter, I won't be able to throw a supernova party with a big explosion…. throwing the outer layers outward in a cloud of gas and dust and leaving in the center a material so heavy that it does not let anything escape, not even light. ….a black hole….

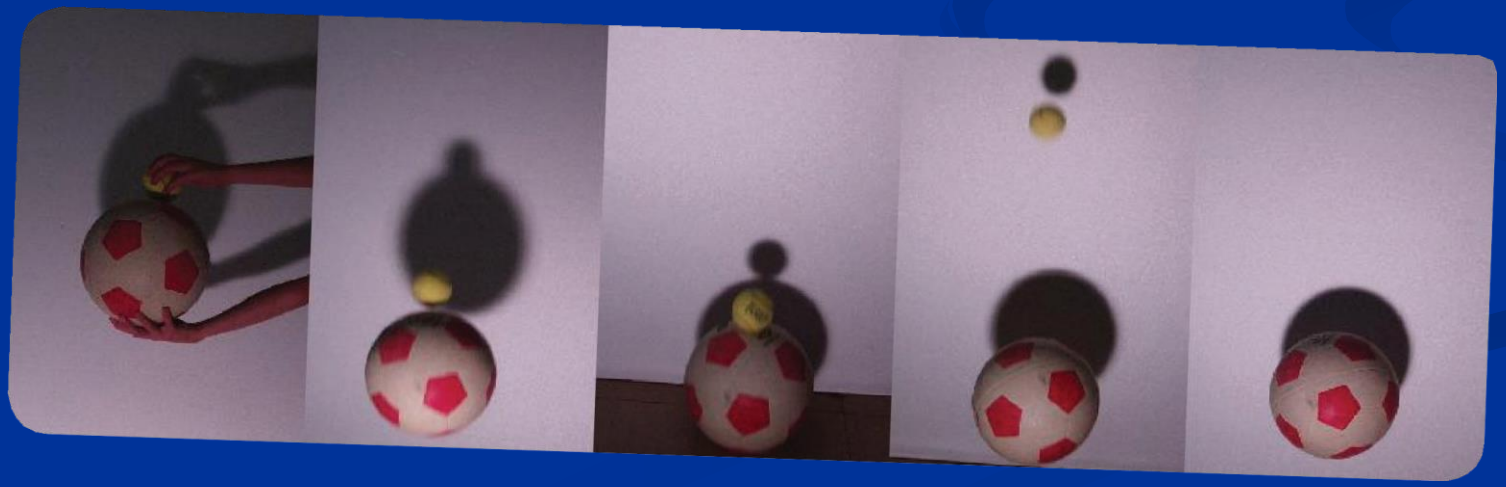
Crédito: cofeekai

… the dwarf stars that are withering and cooling until they are like a "withered fig" of red color, lost in the black sky…

# Activity 5: Ball model!

## Simulation of a supernova explosion

When a star explodes as a supernova, light atoms in the outer layers fall onto heavier atoms inside, and these bounce off the massive central core.

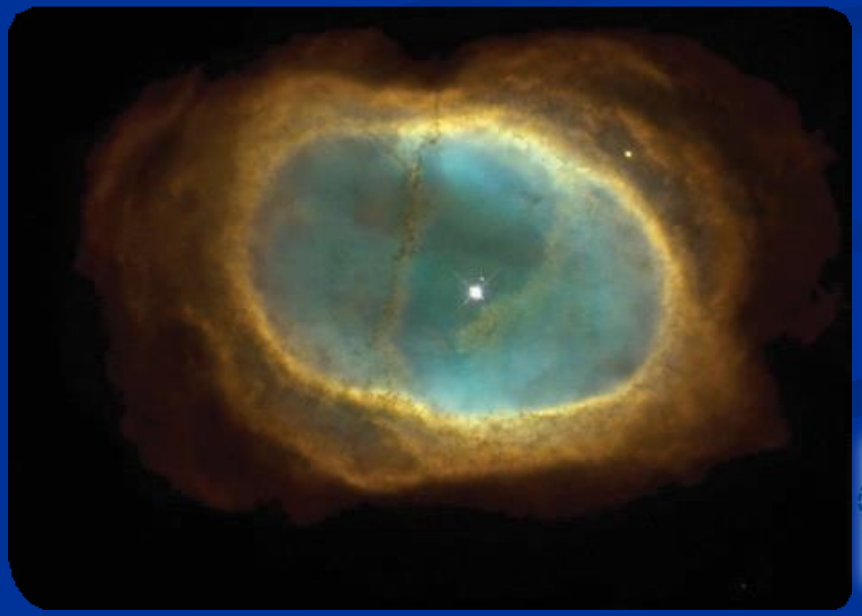


# Activity 5: Balls model!

## Simulation of a supernova explosion

In this model, the ground represents the solid core of the neutron star, the basketball would be a heavy atom that bounces, and in turn pushes the light atom that comes after it, represented by the tennis ball.

Since I am a medium star I have enough mass to throw a party…. It should be cool, without exaggerating, but not ridiculous either… my planetary system and I are going to end up as a beautiful nebula.



… we are all going give rise to a beautiful nebula…. in the center there will be a small memory, a beautiful white dwarf… it will be a party with all my friends, all my planets and we will launch into the universe a cloud of materials of which I have prepared throughout all these years…. Thus there will be other elements distributed in the sky in addition to hydrogen… to help children be born…. All children are made up of the elements that my star friends and I have prepared inside ourselves throughout our lives.

…at your birthday parties you throw streamers and confetti, we will throw stardust into space, which can be used in the creation of life… to form children in their mothers' bellies…..

Tonight, when you look at the sky, remember that you are nothing but stardust.

# Conclusions

- Show that stars evolve over time
- Give simple notions of the process of evolution

Thank you very much
for your attention!