ASTRO EDU

Peer-reviewed Astronomy Education Activities

Stella in una scatola: scuola superiore

Esplora il ciclo vitale delle stelle con l’attività ‘Stella in scatola’.

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KEYWORDS

Evolution, Stars, Lifecycle of stars, Interactive

LOCATION

Spazio limitato al chiuso (per es. classe)

AGE

16 - 19 10 - 12 12 - 14 14 - 16

LEVEL

Middle School

TIME

30m

GROUP

Gruppo

SUPERVISED

No

COST

Basso

SKILLS

Constructing explanations, Communicating information

TYPE OF LEARNING

Technology-based

GOALS

- Capire le differenze dei cicli vitali delle stelle al variare della massa iniziale.
- Dimostrare l'uso del grafico come strumento per esplorare diversi aspetti fisici di un sistema complesso.

LEARNING OBJECTIVES

- Descrivere la relazione tra la massa di una stella e la durata della sua vita.
- Stabilire che le stelle al di sopra di una certa massa concludono la loro vita in una supernova.
- Dare un nome agli stadi principali nel ciclo vitale di una stella, in ordine, per differenti masse di stelle.
- Descrivere la relazione tra la massa di una stella, la sua età e la sua posizione nel diagramma di Hertzsprung-Russell.

BACKGROUND

- Prima di iniziare questa attività, gli studenti devono comprendere a grandi linee cos'è una stella.
- Gli studenti devono avere familiarità con il concetto di fusione e combustione dell'idrogeno.

- Gli studenti devono avere familiarità con l'utilizzo dei grafici per rappresentare e distinguere le informazioni.
- I docenti possono utilizzare la presentazione in Powerpoint che viene fornita per proporre agli studenti una lezione completa del ciclo vitale delle stelle prima di iniziare l'attività (disponibile su http://lco.global/education/starinabox).

FULL DESCRIPTION

Star in a Box app is available at http://starinabox.lco.global

Secondary School Level

Step1

- Open the lid of your 'Star in a Box' .
- The graph is a Hertzsprung-Russell diagram, where a star's luminosity is plotted against its temperature.
- The information panels allow you to compare the Sun with your star. It compares the relative radius, surface temperature, brightness (luminosity) and mass of the star to the Sun.

Step2

The Sun's Evolution during its lifetime.

Click the play button below the Hertzsprung-Russell diagram to show the Sun's evolution.

- Name the three stages of the Sun's life shown on the Hertzsprung-Russell diagram.
    - Stage 1:
    - Stage 2:
    - Stage 3:

Use the table below to describe the changes the Sun will go through between stages.

- Label 'Increase', 'Decrease' or 'Stay the same' for each of the quantities in the table along with the values they change from and to.

	Radius	Luminosity	Temperature	Mass
	. . . Increase	. . . Increase	. . . Increase	. . . Increase
Stage 1 to Stage 2	From: . . . R_{sun} To: . . . R_{sun}	From: . . . L_{sun} To: . . . L_{sun}	From: . . . K To: . . . K	From: . . . M_{sun} To: . . . M_{sun}
	. . . Increase	. . . Increase	. . . Increase	. . . Increase
Stage 2 to Stage 3	From: . . . R_{sun} To: . . . R_{sun}	From: . . . L_{sun} To: . . . L_{sun}	From: . . . K To: . . . K	From: . . . M_{sun} To: . . . M_{sun}

- Look at the light bulb tab:
    - At which stage in its life cycle will the Sun be at its brightest?
    - How old will the Sun be at this point? Myr

- Look at the thermometer tab:
    - At which stage in its lifecycle will the Sun be at its hottest?
    - What is its maximum temperature? K
- Look at the pie chart tab:
    - In which stage of its life will the Sun spend most of its time?
    - How long will it spend in this stage? Myr
- Look at the mass tab:
    - What happens to the mass of the Sun as it gets older?
- What type of star will the Sun be at the end of its life?
- What is the total lifetime of the Sun?

Step3

Using the 'Star Properties' banner, explore the evolution of stars with different starting masses.

- Select a different starting mass for your star in the 'Star Properties' banner.
- Using the Hertzsprung-Russell diagram tab, click play to watch your new stars evolution.
- Try out a few different masses then answer the following questions.
- Using the Hertzsprung-Russell diagram:
- Where on the main sequence do the lower mass stars start?
- Where on the main sequence do the higher mass stars start?
- There are three possible outcomes for the final stage of a stars life depending on its initial mass. Name these 3 possible final stages.

Step4

Follow the evolution of five stars of different masses.

Complete the table below, filling in a row for each of the different masses. Hint: You may find it easier to use the data table on the 'Star in a Box' to find the exact values.

Mass of Star (M_{sun})	Maximum Radius (R_{sun})	Maximum Luminosity (L_{sun}) (Brightness)	Maximum Temperature (K)	Name of Final Stage	Total Lifespan (Myr)
0.2					
1					
6					
20					
40					

Step5

Study the data for the different stars in your table above.

- Comparing the temperatures:
    - Which mass star reaches the highest temperature?
    - At what stage in its life does the star reach this temperature?
- Comparing the luminosities:
    - Which mass star gets the most luminous (brightest)?
    - Is this the same mass of star that reaches the highest temperature?

Step6

Multiple choice questions. Choose the correct answer.

- What type of star will the Sun become after it leaves the Main Sequence?
    - Neutron Star
    - Red Dwarf
    - Red Giant
    - Red Supergiant
- What main factor determines the stages a star will follow after the main sequence?
    - Mass
    - Luminosity
    - Temperature
    - Radius
- The mass of the star Betelgeuse is much greater than the mass of the Sun; therefore, its total lifetime will be:
    - Greater than the Sun
    - The same as the Sun
    - Less than the Sun
- Compared to when it joins the Main Sequence, a star's mass at the end of its life will:
    - Be greater
    - Be the same
    - Be less
    - Depend on the type of star
- The Sun will spend most of its life in what stage?
    - Main Sequence
    - Red Giant
    - Red Dwarf
    - White Dwarf

(solutions at: http://goo.gl/tlaEH1)

EVALUATION

L'accuratezza delle loro risposte alle domande può fornire le basi della valutazione dell'apprendimento degli studenti. Tuttavia si possono ottenere risposte più dettagliate parlando individualmente agli studenti del loro apprendimento.

CURRICULUM

Country	Level	Subject	Exam Board	Section
UK	GCSE	Physics	AQA Science A	Not in current curriculum
UK	GCSE	Physics	Edexcel	P1.3: 11, 12, 13
UK	GCSE	Physics	OCR A	P7.3.8; P7.4: 22-28
UK	GCSE	Physics	OCR B	P2h
UK	GCSE	Physics	WJEC	Physics 3.5: b, c, d, g, j
UK	GCSE	Astrophysics	Edexcel	Unit 1.3: 3o-q, 4a, 4c
UK	A level	Physics	AQA	3.9.2.5
UK	A level	Physics	Edexcel	Topic 10: 159, 160
UK	A level	Physics	OCR A	5.5.1: c, e, g
UK	A level	Physics	OCR B	5.1.3: b, c
UK	A level	Physics	WJEC	Unit 1 6d)
UK	KS3	Physics	-	Space Physics: Our Sun as a Star
UK	KS2: Year 5	Science	-	Earth and Space

ADDITIONAL INFORMATION

- Se vuoi saperne di più sull'evoluzione stellare, dai un'occhiata alle pagine del nostro *SpaceBook* sul ciclo di vita delle stelle. http://lco.global/book/life-cycle-stars
- Puoi anche imparare qualcosa in più sul diagramma di Hertzsprung-Russell sullo *SpaceBook* http://lco.global/book/h-r-diagram
- Le domande negli esercizi possono essere realizzate in un quiz a scelta multipla utilizzando un sito *web* o un'applicazione come *Socrative* https://itunes.apple.com/au/app/teacher-clicker-socrative/id477620120?mt=8.

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CONCLUSION

L'attività si conclude quando gli studenti hanno completato il foglio di lavoro. L'insegnante dovrebbe discutere le varie risposte che gli studenti hanno fornito con particolare attenzione a quelle delle ultime domande.

CITATION

Gomez, E., , *Stella in una scatola: scuola superiore*, astroEDU, 1302 doi:10.11588/astroedu.2013.1.81141