



JWST Captures Giant Star Dust Waves Beyond Solar System

Description

Carbon-rich cosmic dust originates from diverse sources and disperses throughout space, playing a pivotal role in sustaining life and facilitating the formation of rocky planets similar to our own.

Astronomers encounter challenges when observing celestial objects due to this cosmic dust, which obstructs their targets and complicates their investigations.

The James Webb Space Telescope (JWST) was constructed to peer through this dust using its infrared capabilities, providing new insights into astrophysical processes. Recently, the JWST was utilized to study the dust itself.

Research on the Wolf-Rayet binary WR 140, situated approximately 5,000 light-years away in the Cygnus constellation, revealed that the collision of stellar winds from both stars generates expanding rings of carbon-rich dust.

These colliding-wind binaries containing a Wolf-Rayet star offer valuable insights into dust formation processes, shedding light on the mysteries surrounding the dust's composition and resilience.

The chaotic and hostile environment near these stars during close proximity is conducive to the generation of dust when their winds interact. The dust formation occurs exclusively at periastron, resulting in the formation of distinct rings.

Observations made by the JWST in 2022 showcased the expansion of these dust rings following the telescope's initial images taken post the 2016 periastron passage. The swift expansion of the rings highlights the dynamic nature of this binary system.

The ability to witness real-time changes in astronomical phenomena like the expansion of dust rings within a short time frame is a rare occurrence, underlining the unique characteristics of the WR 140 binary system.

These groundbreaking findings underscore the pivotal role of massive binaries like WR 140 in dust production in the cosmos, offering a glimpse into the processes shaping our universe.

Vocabulary List:

1. **Cosmic** /'kɒz.mɪk/ (adjective): Relating to the universe or cosmos especially as distinct from the earth.
 2. **Dust** /dʌst/ (noun): Fine dry particles of matter.
 3. **Facilitating** /fə'sɪlɪteɪtɪŋ/ (verb): Making an action or process easy or easier.
 4. **Astrophysical** /,æstrəʊ'fɪzɪkəl/ (adjective): Relating to the branch of astronomy concerned with the physical properties and behavior of celestial bodies.
 5. **Resilience** /rɪ'zɪl.jəns/ (noun): The ability to recover quickly from difficulties.
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6. **Binaries** /'baɪ.nər.ɪz/ (noun): Systems of two stars that orbit around each other.

Comprehension Questions

Multiple Choice

1. What role does carbon-rich cosmic dust play in space?

- Option: Sustaining life and facilitating the formation of rocky planets
- Option: Blocking observations by astronomers
- Option: Causing disruptions in astrophysical processes
- Option: Creating nebulae in the universe

2. What telescope was used to study the dust in the Wolf-Rayet binary WR 140?

- Option: Hubble Space Telescope
- Option: James Webb Space Telescope
- Option: Kepler Space Telescope
- Option: Chandra X-ray Observatory

3. Where is the Wolf-Rayet binary WR 140 located?

- Option: Orion constellation
- Option: Cygnus constellation
- Option: Andromeda galaxy
- Option: Milky Way galaxy

4. When do dust rings form in the colliding-wind binaries containing a Wolf-Rayet star?

- Option: At apastron
- Option: At periastron
- Option: During supernova events
- Option: During solar eclipses

5. What did the JWST observe in 2022 related to the dust rings of WR 140?

- Option: Reduction in size
- Option: Expansion of the rings
- Option: Disappearance of the rings
- Option: Rotation of the rings

6. What characteristic is highlighted about the WR 140 binary system?



- Option: Static nature
- Option: High temperature
- Option: Dynamic nature
- Option: Low visibility

True-False

7. Astronomers face challenges observing celestial objects due to cosmic dust.
8. The JWST was primarily built to study distant galaxies.
9. The dust formation in colliding-wind binaries occurs at both apastron and periastron.
10. The JWST observations of WR 140 happened before the 2016 periastron passage.
11. The expansion of dust rings in WR 140 displays the stasis of the system.
12. Massive binaries like WR 140 play no role in dust production in the universe.

Gap-Fill

13. The James Webb Space Telescope (JWST) was used to study the dust itself in the Wolf-Rayet binary WR 140 in _____.
14. Dust formation occurs exclusively at _____ in colliding-wind binaries containing a Wolf-Rayet star.
15. Observations made by the JWST in _____ showcased the expansion of these dust rings following the 2016 periastron passage.
16. The Binary WR 140 offers valuable insights into dust formation processes, shedding light on the mysteries surrounding the dust's _____ and resilience.
17. The ability to witness real-time changes in astronomical phenomena like the expansion of dust rings



within a short time frame is a _____ occurrence.

18. Massive binaries like WR 140 have a pivotal role in dust production in the cosmos, offering a glimpse into the processes shaping our _____.

Answer

Multiple Choice: 1. Sustaining life and facilitating the formation of rocky planets 2. James Webb Space Telescope 3. Cygnus constellation 4. At periastron 5. Expansion of the rings 6. Dynamic nature

True-False: 7. True 8. False 9. False 10. False 11. False 12. False

Gap-Fill: 13. 2022 14. periastron 16. composition 17. rare 18. universe

Vocabulary quizzes

Multiple Choice (Select the Correct answer for each question.)

1. Which term describes the introduction of new ideas methods or technologies?

- Option: Innovative
- Option: Missions
- Option: Significance
- Option: Vascular

2. What word describes the indications or characteristics of a physical or mental condition?

- Option: Embarks
- Option: Mitigate
- Option: Symptoms
- Option: Dynamics

3. Which field encompasses the atmosphere and outer space?

- Option: Compete
- Option: Aerospace
- Option: Establish
- Option: Determined

4. What term describes the ability to recover quickly from difficulties or challenges?

- Option: Pivotal
- Option: Resilience
- Option: Excessive



Option: Syndrome

5. Which word means important notable or having a major impact?

Option: Integrate

Option: Vascular

Option: Syndrome

Option: Significant

6. What term describes something that is essential or decisive?

Option: Mitigate

Option: Cosmic

Option: Crucial

Option: Vascular

7. Which word is related to the universe on a vast scale?

Option: Dust

Option: Facilitating

Option: Astrophysical

Option: Cosmic

8. What term means to make less severe serious or painful?

Option: Binaries

Option: Mitigate

Option: Excessive

Option: Dynamics

9. Which term relates to making easier or helping progress?

Option: Mitigate

Option: Dynamics

Option: Facilitating

Option: Establish

10. What term relates to blood vessels or circulatory system?

Option: Binaries

Option: Cerebral

Option: Vascular

Option: Dynamic

Gap-Fill (Fill in the blanks with the correct word from the vocabulary list.)

11. The team _____ on a challenging journey to explore new territories.



12. She was _____ to succeed in her project despite the obstacles.
13. It is important to use _____ language in a professional setting.
14. The CEO made a _____ decision that shaped the future of the company.
15. Too much sugar consumption can lead to _____ weight gain.
16. The movie had an _____ plot that kept the audience guessing until the end.
17. The company aims to _____ a strong presence in the global market.
18. Athletes train hard to _____ in international competitions.
19. The Northern Lights are a natural _____ that amazes observers.
20. Space agencies plan _____ to explore distant planets.

Matching Sentences (Match each definition to the correct word from the vocabulary list.)

21. The scientist provided valuable info into the behavior of the newly discovered species.
22. Computer systems operate using a series of zeros and ones known as .
23. The report the key features of the latest software update.
24. Detectives are skilled at solving complex in crime novels.
25. The political of the region have shifted dramatically in recent years.
26. The doctor explained the symptoms of the rare to the patient.
27. Planting trees helps to the effects of climate change.
28. Astrophysicists study the origins of the universe.
29. Scientists the depths of the ocean to discover new species.
30. The findings of the research had a impact on the medical field.



Answer

Multiple Choice: 1. Innovative 2. Symptoms 3. Aerospace 4. Resilience 5. Significant 6. Crucial 7. Cosmic 8. Mitigate 9. Facilitating 10. Vascular

Gap-Fill: 11. embarks 12. determined 13. appropriate 14. pivotal 15. excessive 16. intriguing 17. establish 18. compete 19. phenomenon 20. missions

Matching sentence: 1. insight 2. binaries 3. characterized 4. mysteries 5. dynamics 6. syndrome 7. mitigate 8. cosmic 9. explore 10. significant

CATEGORY

1. Health - LEVEL5

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