Scientists Measure Universe’s Most Powerful Winds for First Time

Description

Scientists have for the first time measured the speed of hot gas erupting from the heart of the galaxy M82, which produces stars ten times faster than the Milky Way. This gas, moving over 3 million kilometres per hour, could drive a massive outflow of material stretching tens of thousands of light-years into space.

This discovery comes from the XRISM spacecraft, a collaboration between JAXA and NASA. Using its sensitive Resolve instrument, researchers captured X-ray emissions from superheated iron at the core of M82. The research, published on 25 March in Nature, addresses a long-standing question: what drives the powerful outflow observed in this galaxy?

M82 is a starburst galaxy, meaning it consumes gas rapidly, leading to extreme phenomena such as violent winds and colossal outflows. These processes are crucial for understanding galaxy evolution and star formation.

The measurement relied on the Doppler effect, where the movement of light sources shifts its spectrum. At M82’s centre, outwards-moving iron broadens its spectral lines, revealing a wind velocity exceeding 2 million miles per hour. The gas temperature was found to be about 45 million degrees Fahrenheit (25 million degrees Celsius), generating substantial outward pressure that pushes gas into lower-pressure regions.

The data aligns with theories that shockwaves from supernovae heat surrounding gas, starting large-scale winds. The results confirm that the hot inner wind is strong enough to expel four solar masses of gas from the galaxy annually, but three solar masses remain unexplained. This opens new questions for future research on whether this gas escapes M82 or recycles back into it.

Vocabulary List:

1. **outflow** //ˈaʊtˌfloʊ// (noun): movement of gas or material moving out
2. **superheated** //ˌsuːpərˈhiːtɪd// (adjective): heated to a very high temperature
3. **starburst** //ˈstɑrˌbɝst// (noun): a galaxy forming many new stars quickly
4. **spectrum** //ˈspɛktrəm// (noun): range of light or colors from an object
5. **velocity** //vəˈlɑsəti// (noun): the speed and direction of movement
6. **shockwaves** //ˈʃɑkˌweɪvz// (noun): powerful waves of pressure moving through material

Comprehension Questions

Multiple Choice

1. What was measured for the first time from the galaxy M82?

   Option: The speed of hot gas
   Option: The temperature of stars
   Option: The composition of dark matter
   Option: The distance to the galaxy

2. How fast is the hot gas from M82 moving?

   Option: Over 1 million kilometres per hour
   Option: Over 2 million kilometres per hour
   Option: Over 3 million kilometres per hour
   Option: Over 4 million kilometres per hour

3. What instrument on the XRISM spacecraft was used to capture data?

   Option: Resolve
   Option: Spectrum
   Option: Observation
   Option: Analysis

4. What type of galaxy is M82 classified as?

   Option: Elliptical galaxy
   Option: Spiral galaxy
   Option: Starburst galaxy
   Option: Irregular galaxy

5. The gas temperature in the center of M82 is approximately how many degrees Fahrenheit?

   Option: 25 million
   Option: 45 million
   Option: 35 million
   Option: 55 million

6. What drives the powerful outflow observed in M82 according to the researchers?

   Option: Black holes
   Option: Shockwaves from supernovae
   Option: Dark energy
   Option: Gravitational waves

True-False

7. The hot gas from M82 moves at a speed of over 1 million kilometres per hour.

8. The research was published on 25 March in the journal Nature.

9. M82 is consuming gas rapidly and is considered a starburst galaxy.

10. According to the measurement, gas from M82 can escape into lower-pressure regions.

11. Three solar masses of gas from M82 have been completely explained by the research.

12. The measurement was conducted using the Hubble Space Telescope.

Gap-Fill

13. Scientists have measured the speed of hot gas erupting from the heart of the galaxy M82, which can produce stars ten times faster than the _____.

14. The research was published on 25 March in _____.

15. This gas is moving over 3 million kilometres per hour, potentially driving a massive outflow of material stretching tens of thousands of _____ into space.

16. At M82's centre, outwards-moving iron broadens its spectral lines, revealing a wind velocity exceeding 2 million _____ per hour.

17. The gas temperature was found to be about 45 million degrees Fahrenheit (25 million degrees _____).

18. This opens new questions for future research on whether this gas escapes M82 or _____ back into it.

Answer

Multiple Choice: 1. The speed of hot gas 2. Over 3 million kilometres per hour 3. Resolve 4. Starburst galaxy 5. 45 million 6. Shockwaves from supernovae
True-False: 7. False 8. True 9. True 10. True 11. False 12. False
Gap-Fill: 13. Milky Way 14. Nature 15. light-years 16. miles 17. Celsius 18. recycles

Vocabulary quizzes

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

1. What term refers to the act of looking forward to something with excitement?

Option: Contender
Option: Anticipation
Option: Resolution
Option: Capability

2. Which of the following is a term for a competitor for a title or position?

Option: Contender
Option: Surplus
Option: Axis
Option: Rotation

3. What does it mean to have collected or gained something over a period of time?

Option: Synchronize
Option: Garner
Option: Utilize
Option: Fragmentation

4. What term describes the process of developing gradually, especially from a simple to a more complex form?

Option: Evolving
Option: Velocity
Option: Magma
Option: Spectrum

5. What is the term for a specific time or date by which something must be completed?

Option: Deadline
Option: Outflow
Option: Enhancement

Option: Petroglyph

6. What does it mean to start or begin a journey, project, or activity?

Option: Embark
Option: Shockwaves
Option: Resolution
Option: Nucleus

7. What term means to make practical and effective use of something?

Option: Utilize
Option: Velocity
Option: Fragmentation
Option: Archived

8. Which word means improved or increased?

Option: Enhanced
Option: Concentric
Option: Precipitation
Option: Shockwaves

9. What term describes the qualities or features that enable someone or something to perform a task?

Option: Capabilities
Option: Surplus
Option: Magma
Option: Jets

10. What is the term for a firm decision to do or not to do something?

Option: Resolution
Option: Spectrum
Option: Concentric
Option: Nucleus

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

11. A smartphone is a common example of a _____ device that allows users to communicate and access information.

12. Archaeologists discovered ancient _____ carved into the rocks, revealing insights into past civilizations.

13. The unexpected guest _____ on their private dinner party, causing a stir among the

attendees.

14. The artist created a series of _____ circles in her painting, symbolizing unity and harmony.

15. Rain is a form of _____ that is crucial for replenishing the earth's water supply.

16. Underneath the Earth's crust, _____ flows and can cause volcanic eruptions when it reaches the surface.

17. The company reported a significant _____ in its inventory after the holiday season.

18. The _____ of water from the reservoir was carefully monitored to maintain a stable level.

19. The steam became _____ while it traveled through the pipes, increasing in temperature as it moved.

20. The fireworks display ended with a spectacular _____ of color and light in the night sky.

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

21. Velocity is defined as the speed of something in a given direction.
22. Shockwaves are caused by rapidly moving objects, creating disturbances in the surrounding medium.
23. The project documents were archived for future reference and historical purposes.
24. The Earth's rotation on its axis leads to the cycle of day and night.
25. The analysis of data is crucial for making informed decisions and predictions.
26. Jets are streams of gas or liquid that are ejected from a source, often at high speeds.
27. The nucleus of an atom contains protons and neutrons, which are essential for its properties.

28. Fragmentation occurs when an object breaks apart into smaller pieces, often due to stress or impact.
29. Species are constantly evolving, adapting to changes in their environment over time.
30. The new software enhanced the capabilities of the existing system, allowing for improved performance.

Answer

Multiple Choice: 1. Anticipation 2. Contender 3. Garner 4. Evolving 5. Deadline 6. Embark 7. Utilize 8. Enhanced 9. Capabilities 10. Resolution
Gap-Fill: 11. handheld 12. petroglyphs 13. intruded 14. concentric 15. precipitation 16. magma 17. surplus 18. outflow 19. superheated 20. starburst
Matching sentence: 1. velocity 2. shockwaves 3. archived 4. rotation 5. analysis 6. jets 7. nucleus 8. fragmentation 9. evolving 10. capabilities

CATEGORY

1. Sci/Tech - LEVEL4

POST TAG

1. B2
2. clocked
3. ESL learning
4. esl news
5. Level 4
6. universe
7. violent wind

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Author
aimeeyoung99