



Asteroid Won't Strike Earth in 2032, But Will Return!

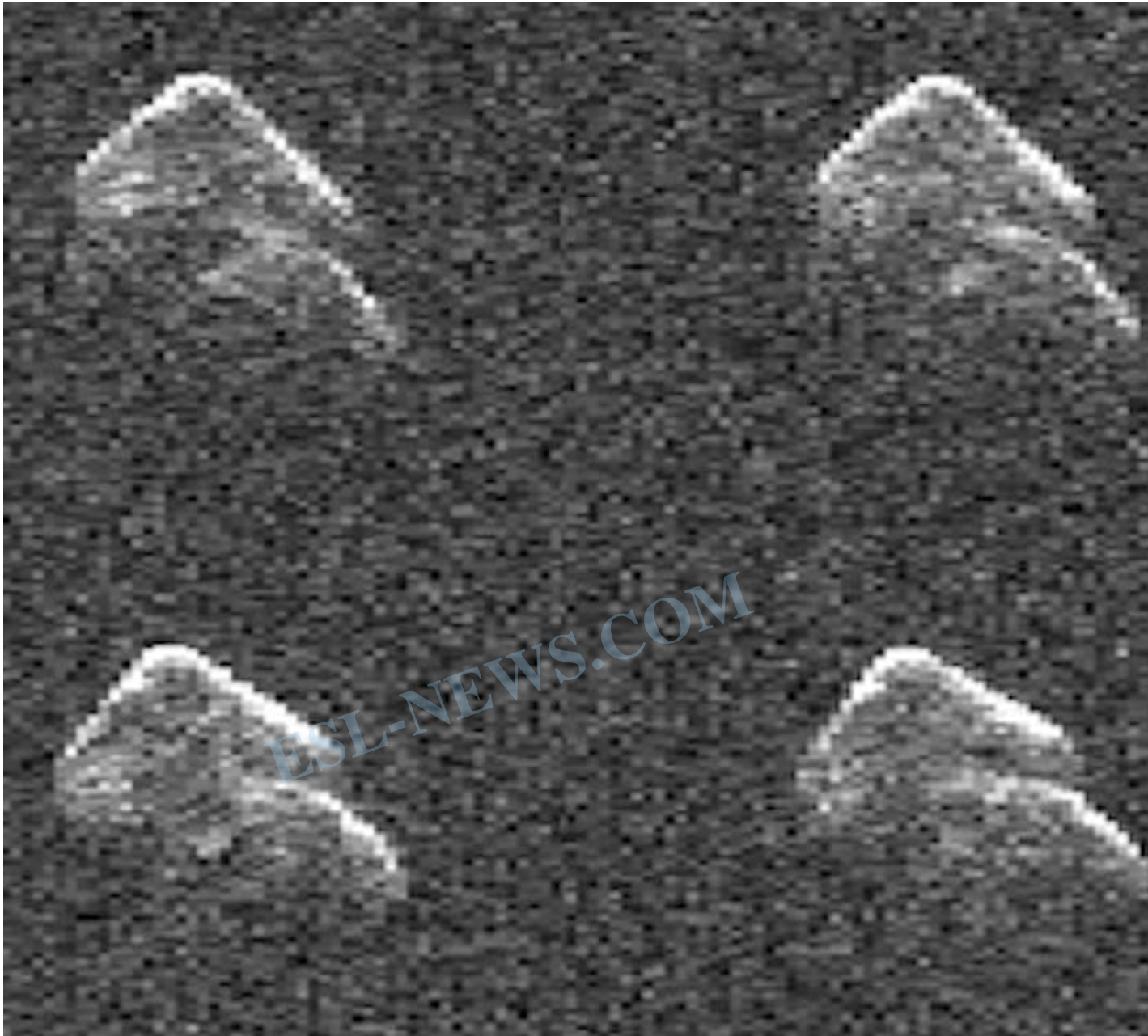
Description

In late 2024, astronomers detected asteroid 2024 YR4 on a potentially hazardous trajectory towards Earth, prompting a concerted observational effort to ascertain its size—estimated to be as large as a football field—and trajectory. Fortunately, it was determined that [a collision with Earth is unlikely](#). Nonetheless, an [impact on the Moon](#) cannot be entirely discounted.

In January of this year, another colossal asteroid, potentially a million times more massive, [passed largely unnoticed](#).

Asteroid 2024 YR4, possessing a diameter of approximately 40 to 90 meters and labeled a "[city-killer](#)", could inflict significant regional devastation and climatic disruption. In contrast, the more substantial asteroid, 887 Alinda, extends over four kilometers in diameter and possesses the capacity to precipitate a global extinction event.

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A radar image of asteroid Alinda taken in January 2024, displaying a rectangular region approximately three kilometers on each side. (NASA/JPL)

Alinda orbits just beyond Earth's path, while 2024 YR4 intersects it, presenting a potential but distant threat of collision.

Asteroid Orbits

Both 887 Alinda and 2024 YR4 complete three orbits around the Sun for every single orbit of Jupiter, which takes about 12 years. As a result, they are set to return to similar paths in 2028, a periodicity that makes them particularly concerning due to their predictable appearances.



Alinda was discovered in 1918 and has undergone several near passes at four-year intervals, while 2024YR4 has been periodically passing close to Earth since 1948, though it has only recently gained attention.

Since the 1970s, intensified focus has emerged regarding asteroids exhibiting a three-to-one relationship with Jupiter's orbit, a phenomenon first identified as noteworthy by American astronomer [Daniel Kirkwood](#) in the late 19th century.

Using sparse data from that era, he observed that none orbited the Sun in simple ratios like two-to-one or three-to-one, nor in more complex configurations.

These so-called [Kirkwood gaps](#) are not readily apparent and are primarily discerned in plots illustrating the average distances of asteroids from the Sun. For approximately a century, they remained an intriguing yet obscure aspect of our solar system.

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Representation of asteroids by their average distances from the Sun, highlighting the Kirkwood gaps. The gap identified as 3:1 contains both Alinda and 2024 YR4, situated at an average distance equivalent to 2.5 times Earth's orbit radius from the Sun. (NASA/JPL)

Advancements in computational technology since the 1970s have elucidated the [resonance effects](#) acting upon such celestial bodies. This resonance occurs when asteroids exhibit motion that aligns with or multiples of Jupiter's orbit speed.

The Kirkwood gaps arise due to asteroids interacting with Jupiter, resulting in their removal from the asteroid belt, even as their mean distances from the Sun remain stable. By encroaching closer to the inner solar system, some of these asteroids are eliminated from the gaps by impacting inner planets like Mars, Venus, or Earth.



Interestingly, the gaps are not entirely devoid of asteroids. Alinda, for example, resides within the three-to-one gap. Subsequent discoveries have identified numerous similar asteroids collectively categorized as "Alindas," named after the initial find whose etymology remains somewhat enigmatic.

The Return of the Asteroids

While the existence of Kirkwood gaps suggests potential hazards from asteroids impacting terrestrial bodies, the implications for Alinda-class asteroids are even more alarming. These asteroids' predictable orbits allow for the alignment conducive to potential impacts on Earth every four years.

Typically, encounters with these asteroids occur over extended intervals; however, once aligned, they return periodically with just four years between approaches. The orbital tilt plays a crucial role; significant tilts reduce the likelihood of crossing paths with Earth.

Unfortunately, both Alinda and 2024 YR4 exhibit minimal orbital tilt, positioning them as more probable candidates for an impact.

The resonant "pumping" mechanism has facilitated 2024 YR4's intersection with Earth's orbit, while the greater concern lies with Alinda, which may be primed for an impact in about 1,000 years due to ongoing orbital changes.

On a positive note, [2024 YR4 is set to miss Earth in 2032](#). However, this near-approach will alter its orbit, reducing the frequency of its return to similar paths.

Despite this alteration, its trajectory will continue to intersect with Earth's orbit, albeit less frequently. Current calculations indicate a somewhat closeness (beyond the Moon's distance) in 2052, with subsequent predictions being less certain.

Monitoring Other Asteroids

Despite the vastness of the solar system, Earth remains prone to impacts.

If 2024 YR4 eluded detection in 2024, what of other asteroids? Notably, the last significant impact occurred undetected on February 15, 2013, over Chelyabinsk, Russia, resulting in numerous injuries due to shattered glass from the explosive shockwave.

A more substantial event transpired in 1908 over [Tunguska, Siberia](#), causing extensive damage to forested areas while resulting in relatively few injuries.



A portion of the extensive Siberian forest destroyed by the Tunguska meteor explosion in 1908; this image was captured in 1929. ([Leonid Kulik](#))

Staying Vigilant

While astronomers meticulously survey the night skies from terrestrial platforms, space-based initiatives, such as the forthcoming [Near-Earth Object \(NEO\) surveyor](#), promise greater efficiency in detecting asteroids. These observatories can identify asteroids via their heat (infrared) radiation and, being situated in space, can also survey the daytime sky.

As asserted by [Amy Mainzer](#), the NEO surveyor's lead scientist, we currently catalog only approximately 40 percent of the asteroids sizable enough to inflict considerable regional harm and that closely approach Earth's trajectory.

Set to launch in late 2027, the NEO surveyor will "find, track, and characterize the most hazardous asteroids and comets," with the objective of achieving the [U.S. Congress-mandated target](#) of identifying 90 percent of all such entities.

Particular attention must be devoted to resonant asteroids, like 2024 YR4, as they are likely to return.



Vocabulary List:

1. **Hazardous** /'hæzədəs/ (adjective): Risky; involving danger or harm.
2. **Trajectory** /trə'dʒektəri/ (noun): The path followed by a projectile or an object in motion.
3. **Devastation** /,devəs'teɪʃən/ (noun): Severe and overwhelming shock or grief; widespread destruction.
4. **Periodic** /,pɪərɪ'ɒdɪk/ (adjective): Occurring at regular intervals.
5. **Asteroid** /'æstərɔɪd/ (noun): A small rocky body orbiting the sun mostly found in the asteroid belt between Mars and Jupiter.
6. **Resonance** /'rezənəns/ (noun): The quality of being deep full and reverberating; the reinforcement or prolongation of sound by reflection or by the synchronous vibration of a neighboring object.

Comprehension Questions

Multiple Choice

1. What was the estimated size of asteroid 2024 YR4?
Option: As small as a car
Option: As large as a football field
Option: As big as a skyscraper
Option: The size of a basketball court
2. Which asteroid has the potential to cause a global extinction event?
Option: 2024 YR4
Option: 887 Alinda
Option: Neither of them
Option: Both of them
3. Which astronomer first identified the phenomenon of asteroids exhibiting a three-to-one relationship with Jupiter's orbit?
Option: Dan Brown
Option: Daniel Kirkwood
Option: John Smith
Option: Sarah Johnson
4. When was asteroid Alinda discovered?



- Option: 1901
- Option: 1918
- Option: 1934
- Option: 1950

5. What is the proposed launch year of the NEO surveyor?

- Option: 2022
- Option: 2025
- Option: 2027
- Option: 2030

6. Why are resonant asteroids like 2024 YR4 of significant concern?

- Option: They are small in size
- Option: They pass close to Earth regularly
- Option: They have a high orbital tilt
- Option: They are unlikely to impact Earth

True-False

7. Asteroid 2024 YR4 poses no significant threat to Earth in 2032 and beyond.

8. Alinda-class asteroids are known to have significant orbital tilts.

9. The NEO surveyor aims to identify 100% of hazardous asteroids and comets.

10. Asteroid impacts on Earth only occur over extended intervals with significant orbital changes.

11. The Kirkwood gaps primarily relate to asteroids interacting with Jupiter.

12. Asteroid Alinda was discovered after World War II.

Gap-Fill

14. Daniel Kirkwood first identified the phenomenon of asteroids exhibiting a three-to-one relationship with Jupiter's orbit in the late _____ century.

15. The first impact event in Tunguska, Siberia, occurred in the year _____.



17. The NEO surveyor is set to launch in late _____.
18. The asteroid impact over Chelyabinsk, Russia, in 2013 resulted in injuries due to _____.

Answer

Multiple Choice: 1. As large as a football field 2. 887 Alinda 3. Daniel Kirkwood 4. 1918 5. 2027 6. They pass close to Earth regularly

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

Gap-Fill: 14. 19th 15. 1908 17. 2027 18. shattered glass from the explosive shockwave

Vocabulary quizzes

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

1. What are the paths followed by asteroids in space called?
- Option: Orbits
 - Option: Trajectories
 - Option: Loops
 - Option: Routes
2. Which term describes the potential danger posed by an asteroid collision?
- Option: Friendly
 - Option: Safe
 - Option: Hazardous
 - Option: Predictable
3. Which lifestyle choice is characterized by little physical activity?
- Option: Active
 - Option: Sedentary
 - Option: Dynamic
 - Option: Vigorous
4. What are new plans or strategies to address a particular issue called?
- Option: Campaigns
 - Option: Endeavors
 - Option: Strategies



Option: Initiatives

5. Which term refers to extreme tiredness resulting from mental or physical exertion?

- Option: Energy
- Option: Vitality
- Option: Fatigue
- Option: Enthusiasm

6. What is the overall health and happiness of a person referred to as?

- Option: Contentment
- Option: Well-being
- Option: Joy
- Option: Satisfaction

7. Which term describes relying on someone or something for support or aid?

- Option: Independence
- Option: Freedom
- Option: Self-reliance
- Option: Dependence

8. Which word means to display or show a quality or feeling clearly?

- Option: Hide
- Option: Conceal
- Option: Reveal
- Option: Manifest

9. What term is used to describe related to heat or temperature?

- Option: Cooling
- Option: Thermal
- Option: Chilled
- Option: Frozen

10. Which word means to isolate or hide away?

- Option: Presented
- Option: Exposed
- Option: Revealed
- Option: Sequestered

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

11. The asteroid _____ can have devastating effects on Earth.

12. The asteroid's _____ visits to our solar system create awe and concern among



astronomers.

13. Genetic _____ can influence one's likelihood of developing certain health conditions.
14. Understanding the causes of _____ is crucial for improving healthcare outcomes.
15. Regular _____ of blood pressure is essential for managing hypertension.
16. The _____ of stress can lead to physical and mental health problems.
17. The team made _____ progress in a short amount of time.
18. Efforts must be made to address social _____ to ensure fairness for all.
19. The study aimed to assess the _____ of the new treatment method.
20. Periodic _____ of business strategies is essential for adapting to market changes.

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

21. The bank required \\\ to secure the loan against default.
22. The marathon runner collapsed from \\\ after crossing the finish line.
23. The medication was effective in \\\ the patient's pain.
24. As a young adult she valued her \\\ and freedom.
25. The new software was designed to \\\ communication among team members.
26. Customer \\\ was evident in the negative online reviews.
27. In her artwork the \\\ color was vibrant red.
28. The mountain spring served as a natural \\\ for the nearby village.
29. The \\\ insulation in the building helped conserve energy.
30. His frustration was \\\ in his tone of voice.



Answer

Multiple Choice: 1. Trajectories 2. Hazardous 3. Sedentary 4. Initiatives 5. Fatigue 6. Well-being 7. Dependence 8. Manifest 9. Thermal 10. Sequestered

Gap-Fill: 11. impact 12. periodic 13. predispositions 14. mortality 15. self-monitoring 16. accumulation 17. considerable 18. inequities 19. efficacy 20. reevaluation

Matching sentence: 1. collateral 2. exhaustion 3. alleviating 4. independence 5. facilitate 6. dissatisfaction 7. predominant 8. reservoir 9. thermal 10. manifest

CATEGORY

1. Sci/Tech - LEVEL5

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