FORMIDABLE END TO LIFE ON EARTH?

The fate of Bennu

PRESENTED BY SERENDIPITY

WHAT WE'LL FOCUS ON

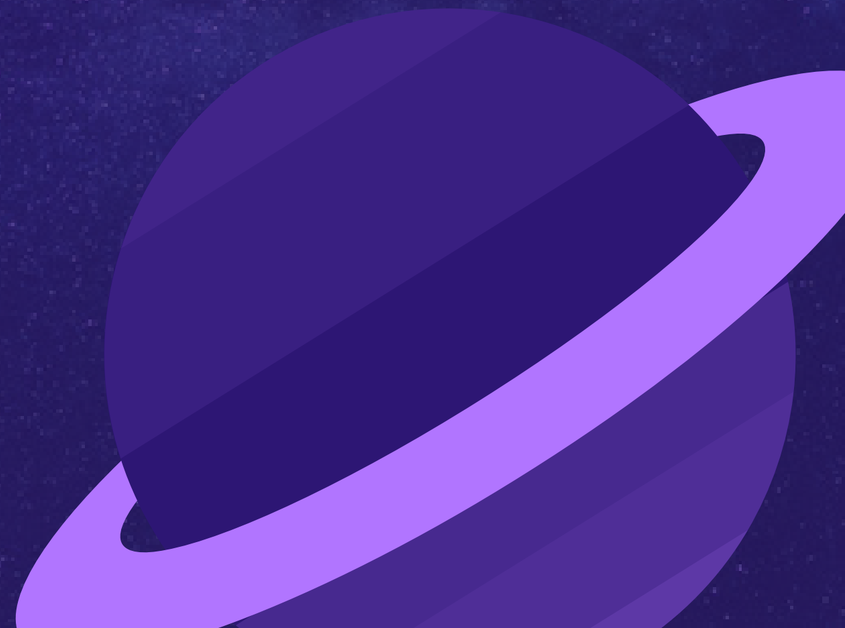
MAIN POINTS OF DISCUSSION

Discovery
Nomenclature
Elements of a Space Opera
Physical Features
Origin and Evolution
Orbit
OSIRIS-REx mission
What the future holds for us?

FOR INSPIRATION

Today's science fiction is tomorrow's science fact.

Isaac Asimov



✨ WHAT IS THE BENNU ASTEROID?

THE MODERN APOCALYPTIC CERTAINTY?

101955 Bennu (provisional designation 1999 RQ36) is a carbonaceous asteroid in the Apollo group discovered by the LINEAR Project on 11 September 1999. It is a potentially hazardous object that is listed on the Sentry Risk Table with the second-highest cumulative rating on the Palermo Technical Impact Hazard Scale. It has a cumulative 1-in-2,700 chance of impacting Earth between 2175 and 2199. It is named after the Bennu, the ancient Egyptian mythological bird associated with the Sun, creation, and rebirth.

DISCOVERY

Bennu was first observed during a Near-Earth asteroid survey by the Lincoln Near Earth Asteroid Research (LINEAR). Bennu approached close to Earth and it was observed extensively by the Arecibo Observatory and the Goldstone Deep Space Network using radar imaging as Bennu closely approached Earth on 23 September 1999.

NOMENCLATURE

Third-grade student Michael Puzio from North Carolina proposed the name, in a contest called "Name the Asteroid" conducted by the University of Arizona. This was in reference to the Egyptian mythological bird, Bennu. The OSIRIS-REx spacecraft with its extended TAGSAM arm resembled the Egyptian deity, which is typically depicted as a heron. Its features will be named after birds and bird-like creatures in mythology.

PHYSICAL CHARACTERESTICS

Rough spheroidal shape, resembling a spinning top

Bennu's axis of rotation is tilted 176 degrees to its orbit; The direction of rotation about its axis is retrograde with respect to its orbit. Bennu has a fairly smooth shape with one prominent 10–20 m boulder on its surface, in the southern hemisphere.
There is a well-defined ridge along the equator of Bennu. The presence of this ridge suggests that fine-grained regolith particles have accumulated in this area, possibly because of its low gravity and fast rotation.Due to the uneven emission of thermal radiation from its surface as Bennu rotates in sunlight, the rotation period of Bennu decreases by about one second every 100 years.Astrometric observations between 1999 and 2013 have demonstrated that 101955 Bennu is influenced by the Yarkovsky effect, causing the semimajor axis to drift on average by 284±1.5 meters/year. Analysis of the gravitational and thermal effects has given a bulk density of ρ = 1260±70 kg/m3, which is only slightly denser than water.

ORIGIN AND EVOLUTION

Rough spheroidal shape, resembling a spinning top

The carbonaceous material that composes Bennu originally came from the breakup of a much larger parent body—a planetoid or a proto-planet. But like nearly all other matter in the Solar System, the origins of its minerals and atoms are to be found in dying stars such as red giants and supernovae. According to the accretion theory, this material came together 4.5 billion years ago during the formation of the Solar System.

Bennu's basic mineralogy and chemical nature would have been established during the first 10 million years of the Solar System's formation, where the carbonaceous material underwent some geologic heating and chemical transformation inside a much larger planetoid or a proto-planet capable of producing the requisite pressure, heat and hydration (if need be)—into more complex minerals.[11] Bennu probably began in the inner asteroid belt as a fragment from a larger body with a diameter of 100 km. Simulations suggest a 70% chance it came from the Polana family and a 30% chance it derived from the Eulalia family

PHOTOMETRIC AND SPECTROSCOPIC OBSERVATIONS

Photometric observations of Bennu in 2005 yielded a synodic rotation period of 4.2905±0.0065 h. It has a B-type classification, which is a sub-category of carbonaceous asteroids. Polarimetric observations show that Bennu belongs to the rare F subclass of carbonaceous asteroids, which is usually associated with cometary features. Measurements over a range of phase angles showed a phase function slope of 0.040 magnitudes per degree, which is similar to other near-Earth asteroids with low albedo.

SURFACE FEATURES

As of August 2019, there are only 4 named features, being the 4 candidate landing sites. All four sites and all future geological features are named after various species of birds and bird-like figures in mythology. [42] No feature has received an official designation by the IAU.

ORBIT

POSSIBLE EARTH IMPACT

On average, an asteroid with a diameter of 500 m (1,600 ft; 0.31 mi) can be expected to impact Earth about every 130,000 years or so.The publication of the shape model and of astrometry based on radar observations obtained in 1999, 2005, and 2011,[12] made possible an improved estimate of the Yarkovsky acceleration and a revised assessment of the impact probability. The current (as of 2014) best estimate of the impact probability is a cumulative probability of 0.037% in the interval 2175 to 2196. This corresponds to a cumulative score on the Palermo scale of −1.71. If an impact were to occur, the expected kinetic energy associated with the collision would be 1,200 megatons in TNT equivalent (for comparison, TNT equivalent of Little Boy was approx 15 kiloton).

2060 close approach

Bennu will pass 0.005 au (750,000 km; 460,000 mi) from Earth on 23 September 2060,[2] and will be too dim to be seen with common binoculars.[50] The close approach of 2060 causes divergence in the close approach of 2135. On 25 September 2135, the nominal approach distance is 0.002 au (300,000 km; 190,000 mi) from Earth, but Bennu could pass as close as 0.0007 au (100,000 km; 65,000 mi).[2] There is no chance of an Earth impact in 2135.

On 25 September 2175, there is a 1 in 24,000 chance of an Earth impact,[10] but the nominal 2175 approach is in February 2175 at a distance of roughly 0.1 au (15,000,000 km; 9,300,000 mi).[2] The most threatening virtual impactor is on 24 September 2196 when there is a 1 in 11,000 chance of an Earth impact.[10] There is a cumulative 1 in 2,700 chance of an Earth impact between 2175–2199.

FACTS & TRIVIA ABOUT BENNU

SIZE	Equatorial mean diameter of 492 meters
APHELION & PERIHELION	1.356 AU and 0.8969 AU respectively
SPEED	28,000 meters per second. Well, that's fast...
CHANCES OF HITTING	1 in 2700, However, recent reports confirm something scary. Optimists are free to think otherwise ;)

OSIRIS-REX : THE MISSION TO THE UNKNOWN

OSIRIS-REX WILL BE THE FIRST U.S. MISSION TO COLLECT A SAMPLE FROM AN ASTEROID AND BRING IT TO EARTH.

Sep 8, 2016: Launch

Sep 22, 2017: Earth flyby

Dec 3, 2018: Asteroid Bennu arrival

Sep 24, 2023: Sample capsule expected to return to Earth.

ABOUT THE MISSION

OSIRIS-REX IS AN ACRONYM FOR "ORIGINS, SPECTRAL INTERPRETATION, RESOURCE IDENTIFICATION, SECURITY-REGOLITH EXPLORER." THE GOAL OF THE MISSION IS TO COLLECT A SAMPLE WEIGHING 2.1 OUNCES (59.5 GRAMS) FROM NEAR-EARTH ASTEROID 101955 BENNU AND THEN TO BRING THE SAMPLE TO EARTH.

After a site has been selected, the mission team will conduct several rehearsals without touching the asteroid. Then in July 2020, the sampling maneuver is scheduled to begin. The entire mission is all about touch and go mission.

WHAT THE FUTURE HOLDS

LOCATION

The mission, developed by scientists at the University of Arizona, will give scientists more information about how the early solar system formed and about how life began. It will also help us better understand asteroids that could impact Earth in the future.

SERENDIPITY

SOMDEV BASU
ANURAG SINGH
SHILPI MUKHERJEE
ANIKET KUMAR

Group A Writing Presentation