

Cosmic Radiation Environment Near the Moon

Prelims: Current events of national and international importance | Science & Technology

Why in News?

Recently, scientific analysis revealed that while radiation levels in deep space near the Moon are higher than in Low Earth Orbit (LEO), the cumulative dose is lower and more manageable than previously modeled.

Key Highlights

Parameter	Key Findings
Experimental Setup (MARE)	Two female-shaped anthropomorphic phantoms (Helga and Zohar) fitted with over 10,000 passive crystal detectors (including high-precision lithium fluoride - LiF dosimeters) were placed in the Orion capsule.
Shielding Efficacy	Zohar wore the experimental AstroRad protective vest (designed to safeguard radiation-sensitive organs), while Helga went unshielded to serve as a baseline control.
Primary Findings	- Radiation doses beyond the Earth's magnetosphere are higher than inside the International Space Station (ISS), but substantially lower than worst-case theoretical predictions. - Heavy cosmic ray ions lose significant energy when penetrating external spacecraft shielding and internal organ density, demonstrating natural biological attenuation.

Strategic Significance

- **Validation for Artemis II & III** - Provides empirical radiation safety margins for upcoming crewed missions (**Artemis II** lunar flyby and **Artemis III** human landing).
- It confirms that short-to-medium duration deep-space stays pose manageable acute radiation risks.
- **Passive Radiation Shielding Design** - Validates the commercial viability of specialized wearable shielding like the AstroRad vest.
- It reduces the payload weight required for heavy metallic hull shielding on deep-space crew modules.

ARTEMIS I MARE RADIATION EXPERIMENT



VEHICLE

Orion Spacecraft
(Deep Space Lunar Distant
Retrograde Orbit)



TEST TARGETS

Humanoid Phantoms (Helga & Zohar)
with >10,000 Detectors

Earth

Orion Spacecraft

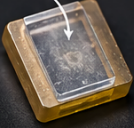
Distant Retrograde Orbit
(DRO)

Moon

1

DOSIMETRY INNOVATION

LiF crystal
detector



Microscopic
track traces

- LiF crystal detectors
recorded microscopic
track traces

2

ASTRO RAD VEST SHIELD



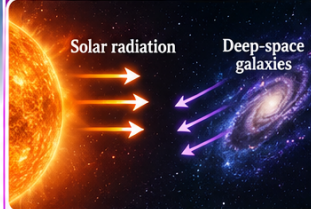
Helga
(Control)

Zohar
(with radiation
shielding)

- Zohar wore a radiation
shielding vest;
Helga served as control

3

LOWER-THAN- EXPECTED DOSE



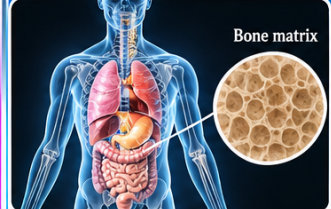
Solar radiation

Deep-space
galaxies

- Deep-space galaxies and
solar radiation dose is
within safe limits

4

ANATOMICAL DEEP MAPPING



Bone matrix

- Mapped radiation
attenuation through
solid organs and bone matrix

Reference

[Science Daily | Radiation levels near the Moon](#)

