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MARSRAD: ALGORITHMIC MODEL FOR MONITORING AND ANALYZING MARS ENVIRONMENTAL EFFECTS ON HUMAN CELLS

Abstract

Mars' thin atmosphere and harsh conditions (0.7 mSv/day radiation, -140C, 6 mbar) endanger human cells, requiring pre-settlement risk assessment (Cucinotta et al., 2017). MarsRad is an algorithmic model to monitor and analyze radiation and environmental factors (dust, temperature, pressure) on cells. ¡300 g sensors measure gamma/proton radiation (0.1-1000 MeV), temperature, and dust; microscopic cameras image m-scale DNA damage. AI analyzes damage types (breaks, oxidative stress) and models risks (cancer, cognitive decline). Data (1 MB/day) is relayed via rover UHF links (e.g., Perseverance) to Earth, informing pre-settlement measures (habitat design, shielding). Simulations in 1/3 g, 6 mbar conditions test the model, though -140C sensor durability, dust interference, and Earth baseline alignment remain uncertain. Advancing beyond dose metrics (Hassler et al., 2014), MarsRad predicts habitation risks. Aligned with "Sustainable Space: Resilient Earth," it supports Mars settlement planning and enhances terrestrial radiation biology.