Shielding Space Radiation

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A shield for space radiation is necessary in long-term space travel to ensure the safety of astronauts. Mars astronauts are projected to receive over 13 times the amount of radiation as a nuclear power plant worker receives in a year. The purpose of this study was to determine which combinations of materials best block radiation, as well as to find out whether the secondary radiation produced by boron-nitride, a material in consideration for this shield, is more harmful than the primary radiation that strikes it. Combinations of polyethylene, water, steel, graphite, and boron-nitride were tested against Cs-137 (a gamma source) for 36 hours per configuration in a custom-made box that allowed for materials to slide in and out. The results were striking; it was found that 3" of polyethylene with ¼" of boron-nitride shielded gamma rays nearly as well as the same amount of polyethylene and ½" of steel. Configurations involving boron-nitride shielded much more radiation than those involving graphite, which is the same density/thickness as boron-nitride without the neutron absorption capabilities. This means that boron-nitride blocks significantly more radiation than it produces and the secondary radiation it produces isn't as harmful as the primary radiation. When considering the feasibility of the design, boron-nitride and polyethylene were recommended to be used together in a space radiation shield. The combination of the two materials blocks a consistent, high amount of radiation, and is lightweight. Eventually, data from this study will be used to design a fabric to be used in spacesuits.