What threats to human health does space radiation pose in orbit

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The Space Shuttle program spanned more than the entire length of a solar cycle. Investigations aimed towards understanding the health risks of the astronauts from exposures to space radiation involved mostly physical measurements of the dose and the linear energy transfer (LET) spectrum. Measurement of the dose rate on the Shuttle provided invariable new data for different periods of the solar cycle, whereas measurement of the LET spectrum using the tissue equivalent proportional counter (TEPC) produced the most complete mapping of the radiation environment of the low Earth orbits (LEO). Exposures to the Shuttle astronauts were measured by the personal dosimeter worn by the crewmembers. Analysis of over 300 personal dosimeter readings indicated a dependence on the mission duration, the altitude and inclination of the orbit, and the solar cycle, with the crewmembers on the launch and repair of the Hubble telescope receiving the highest doses due to the altitude of the mission. Secondary neutrons inside the Shuttle were determined by recoil protons or with Bonner spheres, and may contribute significantly to the risks of the crewmembers. In addition, the skin dose and the doses received at different organs were compared using a human phantom onboard a Shuttle mission.

A number of radiobiology investigations were also performed. The biological doses were determined on six astronauts/cosmonauts on long-duration Shuttle/Mir missions and on two crewmembers on a Hubble repair mission by analyzing the damages in the chromosomes of the crewmembers' white blood cells. Several experiments were also conducted to address the question of possible synergistic effects of spaceflight, microgravity in particular, on the repair of radiation-induced DNA damages. The experimental design included exposure of cells before launch, during flight, or after landing. These physical and biological studies were invaluable in predicting the health risks for astronauts on ISS and future exploration missions.

Educational Objectives:

A group of high school students flew color negative films on two Shuttle missions to detect the radiation environment in orbit. This and other experiments onboard of the Shuttle were aimed at educating the general public of the space program.