

***Moon Base Conference:  
"Jamestown on the Moon"***  
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**Radiation Problems of a Moon  
Base**

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**Summary: Space radiation is a problem but can be handled by proper design, using topography and lunar material for shielding.**

**S.F Singer, in *Physics and Medicine of the Atmosphere and Space* (Otis Benson and Hubertus Strughold, ed. ) John Wiley 1960**

**1. Galactic Cosmic Rays (GCR-p)**

**protons in range of tens of Bev (billion electron volts)**

**2. GCR component of “heavy” nuclei (GCR-h)**

**mainly He; tiny percentage Fe (Z=26) and beyond**

**3. Episodic Solar-produced Hi-Energy Particles (SHEP)**

**Medium–energy protons, (hundreds of Mev to Bev range)**

**High-flux events linked to solar flares; can last days.**

**Difficult to predict; warning time measured in hours.**

# **GCR-p: Not a problem**

**because minimum ionization density**

**Experience in MIR and Space Station**

**No geomagnetic field protection – factor of ~5**

**But no exposure to rad-belt protons.**

**Shielding may increase flux (of secondaries)**

# **GCR-h: Big problem**

**High ion density  $\sim Z^2$  ; like surgical needles**

**Low-Z shielding important to reduce  $Z^2$   
effect by breaking up heavy primaries**

**Combine with magnetic shield?**

# **SHEP: Big problem.**

**Hi flux and ion density**

**Hard to predict. Warning time minutes to hours**

**Mainly unidirectional; simplifies shielding**