Cosmic Ray Secondary Exposure Model for Low Background Detectors
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**Impact of Elevation Above Sea Level:**
Elevation above sea level has a large impact on neutron flux measurements. There is a 40% increase in the neutron flux at all energies at an elevation of 2100m (700 g/cm²) compared to sea level (1000 g/cm²) neutron flux.

**Impact of Solar Cycle:**
Cosmic ray neutron flux and the solar activity cycle (approximated by sunspot number) are anti-correlated, meaning at solar maximum the cosmic ray flux at Earth is reduced and at solar minimum the cosmic ray flux at Earth is increased. There exists a time lag in the reduction of cosmic rays behind the solar maximum by 6-14 months.

**Impact of Shielding:**
There are several factors that affect the shielding of a detector, including depth below ground and the materials used to surround the detector. Above 20 MeV, iron outperforms concrete, water, PE, and BPE in shielding secondaries by a factor of 20 and outperforms lead by a factor of 5. At depths greater than 1000 g/cm², neutron induced reactions are insignificant.

**Conclusions:**
In comparing the various factors described, three models were determined to be the most successful at determining the rate of neutron exposure applied to dark matter detectors: CRY (2012), Ziegler (1998), and Gordon (2004). Future work will determine which model should be used for cosmic ray secondary exposure and how these models should be expanded upon.

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**Impact of Geomagnetic Latitude:**
The Earth’s magnetic field impacts the probability of cosmic ray secondaries reaching sea level. When primary particles hit the Earth’s magnetic field their initial path is bent, and the resulting secondaries’ paths are also bent. The magnetic field can impact cosmic rays reaching sea level by a factor of up to two times. There is also a two times change in flux from the geomagnetic equator to the poles.

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