SESSION X8: GEOPHYSICAL ASTRONOMY
Tuesday Morning, 16 April 2013
Room: Governor's Square 10 at 10:45
Adrian Melott, Kansas University, presiding

Contributed Papers

10:45
X8 1 Astrophysical Ionizing Radiation Sources and Life on Earth* BRIAN THOMAS, *Washburn Unviersity* Astrophysical sources of ionizing radiation have been recognized as a potential threat to life on Earth, primarily through long-term depletion of stratospheric ozone, leading to greatly increased solar ultraviolet (UV) irradiance at the surface. It has been suggested that a gamma-ray burst, in particular, may have initiated the late Ordovician mass extinction - one of the "big five" known extinctions. I will describe the atmospheric impacts of ionizing radiation events and discuss estimates of biological damage under a severely depleted ozone layer. In particular, I will describe new and on-going work to quantify the impact of ionizing radiation events on primary producers in Earth's oceans.

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10:57
X8 2 Search for Supernova ^{60}Fe in the Earth's Fossil Record SHAWN BISHOP, PETER LUDWIG, *Technische Universität München, James-Franck Strasse, 85748 Garching, Germany* RAMON EGLI, *Geomagnetism and Gravimetry, Central Institute for Meteorology and Geodynamics, Hohe Warte 38, 1190 Vienna, Austria* VALENTINA CHERNENKO, *Technische Universität München, James-Franck Strasse, 85748 Garching, Germany* THOMAS FREDERICHS, *Department of Geosciences, Universität Bremen, Klagenfurter Strasse, 28359 Bremen, Germany* SILKE MERCHEL, GEORG RUGEL, *Institute of Ion Beam Physics, Research Center Dresden-Rossendorf, 01314 Dresden, Germany* Approximately 2.8 Myr before the present our planet was subjected to the debris of a supernova explosion. The terrestrial proxy for this event was the discovery of live atoms of ^{60}Fe in a deep-sea ferromanganese crust. The signature for this supernova event should also reside in magnetite (Fe_3O_4) magnetofossils produced by magnetotactic bacteria extant at the time of the Earth-supernova interaction, provided the bacteria preferentially uptake iron from fine-grained iron oxides and ferric hydroxides. Using empirically derived microfossil concentrations in a deep-sea drill core, we deduce a conservative estimate of the 60Fe fraction as $^{60}Fe/Fe = 3.6 \times 10^{-15}$. This value sits comfortably within the sensitivity limit of present accelerator mass spectrometry (AMS) capabilities. This talk will detail the present status of our ^{60}Fe AMS search in magnetofossils and (possibly) show our initial results.

11:09
X8 3 Biological effects of muons from cosmic rays originating from nearby supernova MICHAEL MURRAY, ADRIAN MELOTT, CHISTOPHER FISHER, *University of Kansas* While it is nearly certain that nearby supernovae have affected life on Earth, a determination of the precise effects of these events is frustrated by the lack of certain key information. Indeed, although most cosmic ray primaries are stopped in the atmosphere, secondary particles have the potential to impact both terrestrial and marine life. Of particular interest are muons, which would contribute substantially to the flux associated with a supernova. However, since muons are not an important part of the impact of conventional terrestrial radiation sources, their effects on life have not been well characterized. This can be remedied by experimental studies of effects on DNA from muons produced in neutrino beams. These experiments will be the first serious measurements of muon effects on biological molecules. We also plan to clarify the important relation of damage rates to repair rates, leading toward future *in vivo* work. This will allow a more complete and accurate treatment of these hazards and a comparison with the biological stress resulting from radiation-initiated ozone depletion and solar UVB increase.

11:21
X8 4 Sample Analysis at Mars Organic Contaminants Library (SAM-OCL) RAUL GARCIA-SANCHEZ, PRABHAKAR MISRA, *Howard University* JOHN CANHAM, *ATK Space Systems, Inc.* PAUL MAHAFFY, *NASA GSFC Planetary Environments Laboratory* The Sample Analysis at Mars Organic Contaminants Library (SAM-OCL) was developed as one of several components for the Mars rover mission's Contamination Control Protocol. The purpose of SAM-OCL is to determine the Gas Chromatography-Mass Spectroscopy (GCMS) signals of different materials composing the Mars Science Laboratory rover. In turn, this allows us to determine which GCMS signals originate from terrestrial contamination or rover material outgassing. The GCMS spectral library has several supplemental components, of which its descriptor spreadsheets are the most important, aimed to make SAM-OCL easily and readily accessible to users in and out of the Mars rover mission. One spreadsheet describes the contaminants that can be found in each file, while the other describes the information regarding each file. The library, along with its supplemental materials, is useful from an organizational and practical sense. Through them we are able to organize large volumes of GCMS data while breaking down the components that each material sample is made off. This allows us easy and fast access to information that will be critical when doing analysis in the data that the SAM instrumentation will obtain.

11:33
X8 5 Ground level radiation from cosmic ray shower secondaries ANDREW OVERHOLT, *MidAmerica Nazarene University* Most cosmic ray secondaries never reach ground level, however high energy cosmic rays produce muons and neutrons which do. These particles are known to cause increased radiation and cancer rates under current day cosmic ray flux. Episodic increases in the high energy cosmic ray flux increase this radiation, and thus the risk to biological life. Our work models the flux of neutrons and muons produced by high energy cosmic rays, exploring the possibility of biological impact due to extended periods of increase high energy cosmic ray muon flux. Our results find secondary muon radiation to be significant in cosmic ray flux increasing events.

11:45
X8 6 The Isotropy Problem of Ultra-High Energy Cosmic Rays: The Effects of Anisotropic Transport RAHUL KUMAR, DAVID EICHLER, *Ben- Gurion University* Time dependent anisotropic transport of ultra-high energy cosmic rays (UHECRs) from point-like sources in the Galaxy is calculated in various ways. To fully account for the discreteness of UHECR sources in space and time, the Monte Carlo method is used to randomly place sources in the Galaxy and calculate the anisotropy of UHECR flux, given specific realisations of source distribution. We show that reduction in the rate of cross-field transport reduces the anisotropy. However, if the crossfield transport is very small, drift of UHECRs in the Galactic magnetic field (GMF) becomes the dominant contributor to the anisotropy. Test particle simulations further illustrate the effect of drift and verify our analytical calculation. The surprisingly low