

# Elemental and Isotopic Abundances and Their Implications for Cosmic Ray Origins

*Friday, 27 September 2013 15:05 (25 minutes)*

The answer to the question of the origin of galactic cosmic rays lies not only with directional anisotropies for the highest energies where direction is preserved but also with in the signatures found in their energy spectra and composition. Elemental and isotopic measurements carry the imprint of nucleosynthesis, acceleration time scales, and residence times within the Galaxy. Recent isotopic measurements with the Cosmic Ray Isotope Spectrometer (CRIS) from ~80-600 MeV/nucleon aboard the Advanced Composition Explorer (ACE) satellite as well as elemental data from Mg through Sr from the Trans-Iron Galactic Element Recorder (TIGER), suggest an origin linked to OB associations. GCR ratio measurements of  $^{22}\text{Ne}/^{20}\text{Ne}$ ,  $^{58}\text{Fe}/^{56}\text{Fe}$ , and  $^{31}\text{Ga}/^{32}\text{Ge}$  in particular, are consistent with a source material that is a mixture of the interstellar material (with solar system abundances) and outflow/ejecta from massive stars. (The following is a complicated concept and may need to be longer to get the points across. I don't understand it.) Furthermore, the ordering of refractory and volatile elements with atomic mass is improved if the source material includes massive star outflow/ejecta, resulting in power-law trend with atomic mass with similar slopes for both but with refractory elements preferentially accelerated by a factor of ~4. Together with recent observations of high-energy gamma-rays from SNRs and extended sources, we conclude that the likely source of GCRs is consistent with an origin in OB associations and their associated superbubbles.

**Primary author:** Dr DE NOLFO, Georgia (NASA/GSFC)

**Co-authors:** Dr CUMMINGS, A.C. (California Institute of Technology, Pasadena, CA 91109); Dr STONE, E.C. (California Institute of Technology, Pasadena CA 91125); Dr CHRISTIAN, E.R. (NASA/Goddard Space Flight Center, Greenbelt MD 20771 USA); Dr WIEDENBECK, M.E. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA 91109); Dr ISRAEL, M.H. (Washington University, St. Louis MO 63130); Dr LESKE, R.A. (California Institute of Technology, Pasadena CA 91109); Dr MEWALDT, R.A. (California Institute of Technology, Pasadena CA 91125); VON ROSENVINGE, T.T. (NASA/Goddard Space Flight Center, Greenbelt MD 20771); Dr BINNS, W.R. (Washington University, St. Louis, MO 63130)

**Presenter:** Dr DE NOLFO, Georgia (NASA/GSFC)

**Session Classification:** Elemental and Isotopic Abundances and Their Implications for Cosmic Ray Origins - Georgia De Nolfo, NASA/GSFC

**Track Classification:** Georgia De Nolfo (maybe)