

Auroral Spectra as a Tool for Detecting Extra-Terrestrial Life

Syun-Ichi Akasofu¹ (907-474-6012); sakasofu@iarc.uaf.edu)

Dirk Lummerzheim² (907-474-7564; lumm@gi.alaska.edu)

Harald U. Frey³ (510-643-3323; hfrey@ssl.berkeley.edu)

¹International Arctic Research Center, University of Alaska P.O. Box 7340, Fairbanks, AK 99775-7340, United States

²Geophysical Institute, University of Alaska P.O. Box 7320, Fairbanks, AK 99775-7320, United States

³Space Sciences Laboratory, University of California, Berkeley, CA 94720-7540, United States

It is our hope that terrestrial Aeronomy will develop in a great number of ways. Aeronomy of the planets of the solar system is an obvious extension which has already been vigorously pursued. We suggest here that Aeronomy may be a tool for detecting extra-terrestrial life.

One of the most prominent emissions from the aurora is the greenish-white light from oxygen atoms, while the Jovian aurora contains atomic hydrogen emissions. The oxygen emissions, the so-called “green line” (557.7 nm) of the terrestrial aurora, arises mostly from the fact that plants release abundant free oxygen into the atmosphere by the photo-synthesis process. Thus, intense oxygen emissions might be an indication that plant life exists on planets of extra-solar systems. However, in order to make certain our inference, it is best to examine all possible line and band emissions (from IR to EUV), their intensity ratios and other characteristics. The dissociation of CO₂ and other molecules can also release oxygen. However, if the condition of the planets is similar to that of the Earth, its contribution is expected to be very small.

It was recently reported that Upsilon Andromedae has three planets. This star is a solar-type star. This discovery and many others in recent years are significant because they show the planetary system, like the solar system, is not quite unique. It is expected that a number of stars are accompanied by several planets, and it may not be too long before the aurora on such planets can be discovered. The Earth-like auroral processes leading to the oxygen emissions require, in addition to plant life, both stellar wind and planetary magnetism. It is highly probably that solar-type stars have stellar wind.

It is hoped that auroral science could contribute to the search for extra-terrestrial life (one of the ultimate human endeavors) and to many other important research fields including global change. Such “applied” research could develop Aeronomy as “pure” science as well.