New Instrument in Antarctica for the observation of faint auroral signatures

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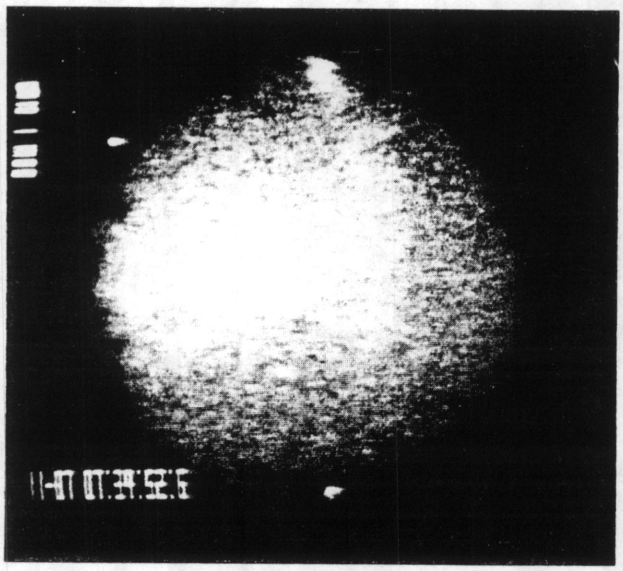
In a continuing program of investigating natural atmospheric emission phenomena on the antarctic continent, Lockheed Palo Alto Research Laboratories have collaborated with Boston College in the construction and fielding of a special purpose photometric instrument for the detection and recording of faint auroras which are precipitating particle-induced optical emissions.

The earlier phase of the program at Siple (the detection of the particle-induced optical emission) has been a great success. Photometers were used in coordinated experiments with both very-low-frequency (VLF) and ultra-low-frequency (ULF) wave detectors. With these instruments it was found that auroral light emissions often accompanied by wave activity which was detected at Siple Station. The auroral light is caused by energetic particles which are falling into the upper atmosphere. Thus, the auroral light detection, which is correlated with the waves, clearly demonstrates that the two phenomena are closely coupled. The observed correlations added to our understanding of wave-particle interactions (Helliwell, Mende, Doolittle, Armstrong, and Carpenter in press; Mende, Arnoldy, Cahill, Doolittle, Armstrong, and Fraser-Smith 1980).



Example of a television frame of the type of pulsation data expected to be seen at Siple. This actual frame was taken at Roberval, Canada with a similar television system. The brighter circle represents the horizon as seen by the wide angle fish-eye lens of the camera. The bright region on the left part of the picture is a low intensity subvisual auroral pulsation intensified by the television system.

Unfortunately, the photometric observation technique did not provide any spatial resolution regarding the size and location of the light-emitting regions. Recently it has become possible to build very sensitive television systems that form an image of the entire sky at very low light levels (Mende, Eather, and Aamodt 1977). Such a television system was built and fielded at the conjugate of the field line at Roberval, Canada some years ago. The figure shows a picture of an actual very low intensity pulsation observed by this television system at Roberval. The brighter circle represents the horizon boundary of the sky as seen by the wide angle (fish-eye) lens of the camera. The bright region on the left part of the picture is an auroral pulsation of the type that we are hoping to detect and to correlate with the wave experiments at Siple this (1980) austral winter.

Last year, therefore, we built a new television camera for installation at Siple and for operation in the austral winter of 1980. During the 1979–1980 austral summer we successfully installed the television system at Siple Station.

In addition to the television, we operate a two-channel zenith viewing photometer and a six-channel meridian scanning photometer at Siple. R. Squires is wintering with the instrumentation at Siple Station.

We are looking forward to being able to make a definitive study based on the new data about the nature of the wave-particle interactions observed at Siple. The data-taking cycle started with the darkness of the 1980 austral winter.

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References

Helliwell, R. A., Mende, S. B., Doolittle, J. H., Armstrong, W. C., Carpenter, D. L. 1980. Correlations between 4278 optical emissions and VLF events observed at L4 in the Antarctic. *Journal of Geophysical Research*, 85, 3376.

Mende, S. B., Arnoldy, R. L., Cahill, L. J., Jr., Doolittle, H. J., Armstrong, W. C., and Fraser-Smith, A. C. 1980. Correlation between 4278Å optical emissions and Pc 1 pearl event observed. *Journal of Geophysical Research*, 85, 1194.

Mende, S. B., Eather, R. H., and Aamodt, E. K. 1977. Instrument for the monochromatic observation of all sky auroral images. *Applied Optics*, 16, 1691.