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AURORAL IMAGES FROM SPACE 3

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The Spacelab 3 space shuttle mission of April 29-May 6, 1985, provided an excellent opportunity to survey the Aurora Australis from near-Earth orbit. The orbital inclination and Beta angle were such that the orbit penetrated the average auroral oval in darkness. (Some aspects of the observations were compromised by scattering of moonlight from the clouds below.) Since this was a manned mission, it was practical to use imaging detectors that required aiming and high-bandwidth recording. We obtained 274 color photographs of the aurora and approximately 5 hr of black and white video recordings. The data cover 22 separate passes from seven days. On several occasions the Orbiter passed above the auroral forms. By using the orbital motion to provide the parallax, we have been able to view both the color photographs and the video recordings stereoscopically.

The data provide the first views from outside the atmosphere of thin horizontal layers of "enhanced aurora" (Fig. 1). The layers, once thought to be rare, were recorded on two out of three passes. This first observation of enhanced aurora from space eliminates concerns that the ground-based observations might have been an optical illusion caused by atmospheric refraction. Also, for the first time, vertically thin layers were observed in diffuse aurora. This is a measurement that is possible only from space ideally in nearth-Earth orbit.

Figure 1. The Aurora Australis seen from Spacelab 3. The thin uniform band parallel to the Earth's curved line is an edge-on view of the airglow layer at ~95 km altitude. A rayed auroral arc is seen just above the airglow layer and bending equatorward to pass under Challenger seen in the foreground. The rays in the arc have vertical extents of ~60 to 200 km, but there is a very thin (<2 km) band of enhanced auroral emission running through the aurora near the base of the rays. In the color photographs this is easily distinguished from the airglow layer beneath it.