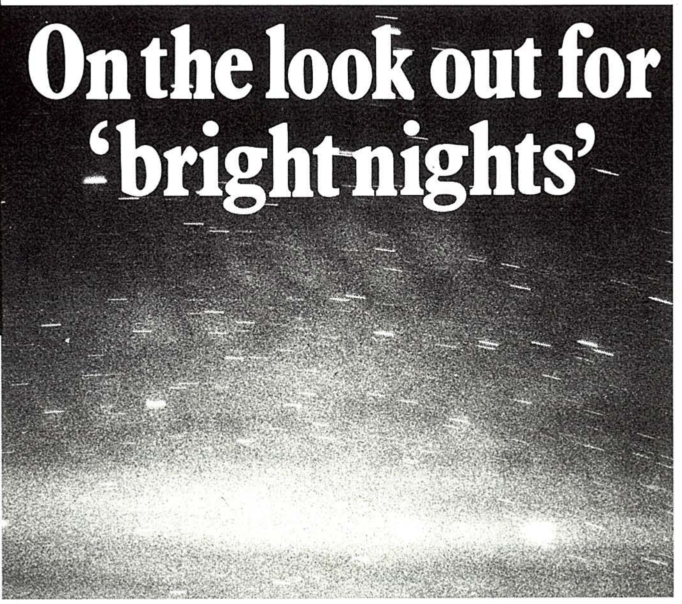
BACK BOX

On the look out for ‘bright nights’



Waves and ripples in the clear night sky — a 3-minute exposure on infra-red film. On some bright nights, the eye can see similar waves.

‘It’s like looking at a sandy bottom through a very deep, faintly green, clear sea’, explains Dr Brian Armstrong of the CSIRO Solar Observatory, describing how the sky, unusually luminous, appears on ‘bright nights’.

Accounts of the phenomenon can be found in last century’s astronomical literature, but nowadays it is rarely reported, probably because of prevalent ‘light pollution’.

The sky must be free of the glow of street lights (so you’d best be far out in the country) and the observer’s eyes must be thoroughly dark-adapted (no lights or television whatsoever for at least half an hour). In addition, the sky has to be perfectly clear and moonless — one of those magical nights when the stars glimmer right from one horizon to the other. If you are lucky, you may be rewarded with a display of a bright night.

However, on any night you will find that the celestial background in which the stars are embedded isn’t jet black — the horizon appears that extra bit darker again.

Half of the additional brightness is scattered starlight; the rest comes from the atmosphere itself, faintly glowing.

The aptly named ‘airglow’ originates from a layer in the upper atmosphere at an altitude between 80 and 110 km. Photographs taken from space show it as a bright narrow band ringing the night-time earth.

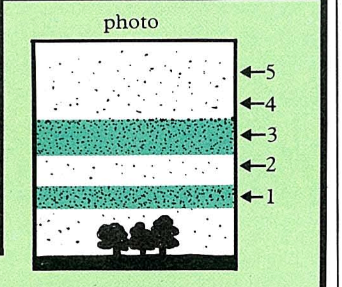
Light-emitting reactions in the tenuous gases of the upper atmosphere cause it. The processes are similar to those that make a gas flame luminous.

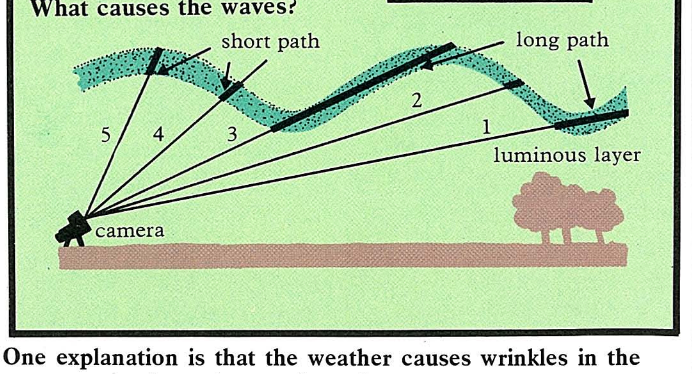
Sunlight energizes the airglow gases during the day, and at night the reactions reverse, liberating excess energy, some as light.

The scientific study of the airglow has absorbed Dr Armstrong for many years. With sensitive light-amplifying equipment, spectrometers, and cameras, he has spent countless evenings under the starry pellucid skies that prevail just outside Culgoora, N.S.W., site of the Solar Observatory of the CSIRO Division of Applied Physics.

He has recorded thousands of airglows, dozens of auroras, but only a handful of bright nights. Although related, the three phenomena are distinctly different.

The aurora is due to solar particles, at times of enhanced solar activity, exciting gases in the upper atmosphere. Some spectral lines are common to both auroras and airglow, but it is generally possible to tell them apart. However, Dr Armstrong’s spectrometer cannot distinguish bright nights from airglow. Bright nights are therefore not faint auroras, but airglow phenomena of some kind.





One explanation is that the weather causes wrinkles in the upper atmosphere that produce the wave pattern we see.

Their exact cause remains unknown, and the mystery is deepened by observations of waves sometimes moving across them.

On two nights, Dr Armstrong saw broad, faint, greenish bands low in the sky and parallel to the horizon, and as he watched they slowly moved upwards and vanished. Throughout the night, a progression of bands appeared and disappeared.

He took photographs of the bands with very sensitive infra-red film and with a photoelectric image-intensifying system. From these he calculates that the waves had a wavelength of 244 km and a speed of 72 m per second.

At other times the waves have revealed themselves on his equipment, but were invisible to the unaided eye.

Dr Armstrong speculates that they could be due to gravity waves travelling through the region, which causes the airglow layer to wrinkle. A gravity wave is one in which gravity provides the restoring force, as it does for waves on the surface of the ocean. In the upper atmosphere, gravity waves can be formed when parcels of air are perturbed by the motions of cyclones, fronts, and other weather effects lower down.

One of the weather’s far-ranging effects may be the movement of luminous clouds of gas far up in the night sky.

Andrew Bell

The association of visible airglow features with a gravity wave. E.B. Armstrong. *Journal of Atmospheric and Terrestrial Physics*, 1982, **44**, 325–36.