the broad cosmic abundance peaks centered at mass numbers 80, 130 and 195. Trans-bismuth elements are also formed in large abundances by this mechanism.

(3) Photonuclear reactions on the products of the slow neutron capture time-scale. If in supernova explosions, probably of Type II, the hydrogen is not exhausted in the exploding layers, the production of neutrons by (α, n) reactions is negligible. However, if the temperature reaches $\sim 2 \times 10^9$ °K for a few seconds, then a few neutrons and a smaller number of protons can be ejected by photonuclear reactions from heavy nuclides previously produced in the layer by neutron capture on the slow time-scale. This produces nuclides on the neutron deficient side of the nuclear mass valley but leaves the general abundance trend unchanged from that produced by the neutron capture on the slow time-scale.

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Atomic Energy of Canada, Limited.

Chamberlain, Joseph W. and Negaard, Beverly J.
Effects of resonance scattering of the nightglow D lines on the van Rhijn heights.

Chandrasekhar's theory of radiative transfer is applied to the layer emitting the Na D lines in the nightglow to investigate the problem of height determinations by zenith-horizon photometry. Theoretical expectations based on considerations of atmospheric photochemistry, the Na twilight flash, and the recent rocket flights into the emitting layer all indicate a height around 85 km for the majority of free Na atoms. However, nightglow photometry has consistently given considerably higher emitting layers.

Three models for the nightglow are considered: primary excitation at the bottom of a thin Na layer, evenly distributed through the layer, and concentrated at the top. If the last model is approximately correct, the great heights deduced from the van Rhijn technique are understandable, since the effect of self absorption will be sufficient to simulate a height much greater than the true height. Alternatively, the Chapman photochemical reaction for exciting Na, which currently appears to be the most likely mechanism, would concentrate the emission near the lower boundary of the layer. In this case resonance scattering at the optical thicknesses encountered in the D-line profiles will not produce

enough apparent rise in the layer to be important and some other source for the anomaly must be sought. This research has been supported in part by the Air Force Cambridge Research Center, Air Research and Development Command.

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Williams Bay, Wis.*

Cook, A. F. and Hawkins, G. S. The meteoric head echo.

Two proposed explanations for the radar echo observed to follow the head of many meteors have been put forward. The diffraction theory of Browne and Kaiser has been adequately disproven by McKinley. The suggestion of McKinley and Millman that ionizing radiation from the head is the cause is considered. It appears that the critical quantity is $An_e R/v$, where A is the volume recombination coefficient, n_e is the critical electron density for the wave length considered, v is the velocity of the meteor and R is the radial distance from the meteor at which the critical electron density occurs. Account is taken of refraction of the radio waves in the region of ionization outside the surface of critical electron density and it is shown that the true value of R is nearly twice that deduced using the model of a reflecting metallic sphere.

Substitution of known values into the critical dimensionless expression above indicates a failure of the quantity to be large enough by some four orders of magnitude to explain the observed roughly spherical echoes. If some sort of radiation from the meteor is to be postulated as the cause, a mechanism which will make An_e about ten thousand times larger than for molecular ions and electrons is required.

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Cambridge, Mass.*

Courtes, Georges. Some results and improvements of interferometric observations of galactic emission nebulae.

This work has included the following three programs:

1. *Radial velocities of distant HII regions.* These velocities, with few exceptions, are in relatively good agreement with the differential galactic rotation and distances given by W. W. Morgan *et al.* (1952). The agreement is especially good for the nebulae in the second farthest spiral arm of the Milky Way, longitudes 70° to 110° , radial