Taylor expansion of the Planck function in powers of τ.

The operational method gives an expansion of the "source-function"

$$J_\nu(\tau) = \tfrac{1}{2}(1 - \lambda)\int_{-1}^{+1} I_\nu(\tau, \mu)d\mu + \lambda(a + b\tau), \quad (2)$$

in the form

$$J(\tau) = a + b\tau + ce^{-m\tau} + \sum_0^\infty A_j K_{j+2}(\tau), \quad (3)$$

where m is the positive root of the equation

$$m = (1 - \lambda) \tanh^{-1} m, \quad (4)$$

$K_n(\tau)$ is the exponential integral of the nth order, defined by

$$K_n(\tau) = \int_1^\infty \frac{e^{-x\tau}}{x^n} dx, \quad (5)$$

and c and the A_j's are constants which are found to be the solutions of a set of n simultaneous linear equations in the nth order. Finally, the quantities r and R, defined as the ratios of the emergent intensities and fluxes in the line and continuum respectively are obtained as functions of λ, ν (frequency), c and the A_j's.

The equations have been solved for a four-term expansion of $J(\tau)$ in (3), and the values of R obtained by the operational method have been tabulated for the standard value of $\lambda = 0.2$ and various values of the parameter x which is a function of the frequency ν. They are more accurate than the values obtained by Chandrasekhar[2] in the third approximation by Gaussian quadrature and comparable in accuracy to the values obtained by him[3] from the $H(\mu)$ function and its moments.

A special feature of the operational method is the correct evaluation of the index of the exponential in (3). The method also is not restricted to the atmospheric surface, but enables one to evaluate the "source-function" $J(\tau)$ in (3) for any τ.

1. *Ap. J.* **110**, 1, 1949.
2. *Ap. J.* **100**, 355, 1944.
3. *Ap. J.* **106**, 145, 1947.

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Moser, Nora B. Calculation of the shadow path of a chosen lunar feature during an occultation.

The accuracy of occultation observations has had two serious limitations: the inaccuracy of visual observation and the influence of limb irregularities. As a development of A. E. Whitford's photoelectric measurements of stellar diameters, mobile equipment has been designed to observe an occultation photoelectrically and record it alongside radio time signals to thousandths of a second. To cancel out the effect of limb irregularities, a prominent lunar feature which will dominate the limb for several hours is selected and two or more observation posts are so placed that at each the star will disappear behind the chosen feature.

A suitable occultation having been chosen, Hayn's selenographic coordinates of the edge of the moon as presented to the earth at a given time are computed by Watts' method.[1] The results are plotted on Hayn's contour charts of the limb region, and a prominent mountain within about 2° of the edge line is picked. The selenographic coordinates of the top of this mountain, together with more or less arbitrary times, will be the starting data for computing the shadow path along which the mountain will occult the star.

To obtain maximum precision, the moon's positions, tabulated with an extra decimal place, are requested from the British Nautical Almanac Office, and the earth's selenographic coordinates (librations) are computed from basic formulas rather than interpolated from published tables. The path of the shadow axis on Bessel's fundamental plane is calculated by standard formulas. Some significant figures are lost in subtraction in this process but the relative error between points on the shadow path will be negligible.

The geocentric earth's selenographic coordinates and position angle of the moon's axis are referred to the shadow axis by Watts' method for selenographic coordinates, avoiding his approximations. The selenographic coordinates of the shadow axis and of the chosen mountain are transformed to one set of rectangular coordinates fixed in the moon and then projected onto the fundamental plane, resulting in the shadow path of the mountain. Bessel's device of a parametric declination is employed in transferring the path to the earth's surface.

The observation positions are tied into the U. S. first-order triangulation and may be assumed correct. The error in the moon's place will be sensibly constant during one occultation. The limb error is under control. An observation equation may be set up to solve for the correction to the lunar parallax.

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