even spectral resolutions greater than 10^1–10^2 are "high", spectrometers of $\lambda/\Delta\lambda < 10^3$ were in fact in orbit[9] as early as 1967.

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Night-time reception of solar radio events

RIIHMAA has reported night-time reception of a solar radio event[1]. The observation, in the frequency range 20.85–23.20 MHz, was made at Kiiminki (65°05′N, 25°54′E) on 30 March 1976 with the Sun (and Jupiter) well below the horizon. Night-time reception of solar bursts had also been reported by Smith *et al.*[2]. Such night-time solar radio burst reception might be brought about by anomalous propagation associated with plasma waves in the lower ionospheric E layer. I briefly discuss this phenomenon here and point out the possible importance of large ionospheric electric fields.

Riihmaa[1] argues that "in the present case the bursts must have been guided from the sunlit hemisphere over the polar regions. It may be significant that on the night of 30 March an auroral substorm and a strong blanketing sporadic-E (E_s) were observed. A suitable duct may have existed between the ground and the E_s layer." The total attenuation was estimated to be of the order of $\simeq 10$ dB (ref. 1 and personal communication).

The question arises as to what mechanism(s) may bring about the anomalous propagation of the bursts into the night-time hemisphere. Since ray bending and geometrical optics considerations do not seem to suffice, one may resort to a slightly more sophisticated approach.

An E layer in which electric fields above a nominal threshold of ~ 25 mV m^{-1} excite Farley–Buneman waves[3,4] of sufficiently large amplitude, may provide enough reflectivity to the $\simeq 20$ MHz radiation and 'guide' it over the polar region into the night-time hemisphere. I have considered the reflectivity of a Farley–Buneman unstable E layer in a brief paper on riometers[5]. For details see ref. 5 and refs therein.

In the present connection we need only note the following. Reflection of 20-MHz radiation (wavelength $\lambda = 15$ m) by a system of plane parallel plasma waves occurs by Bragg scattering when the relation $\lambda = 2\lambda_n \cos\theta$ is satisfied, λ_n being the relevant wavelength of the plasma waves and θ the angle of incidence. With $\alpha = \pi/2 - \theta \ll 1$ the above relation reads $\lambda \simeq 2\lambda_n \sin\alpha \simeq 2\lambda_n\alpha$. A typical angle α under which 20-MHz 'rays' from the Sun 'graze' from below the bottom part of the polar cap E layer and are reflected into the night-time hemisphere is $\alpha \sim 0.2$ rad $\sim 10°$. Then the appropriate plasma wavelength for reflection is $\lambda_n \simeq 40$ m. Plasma wavelengths of ~ 40 m (in the present case the geometry is such that λ_n is to be understood as the plasma wavelength along the geomagnetic field lines) are available among the Farley–Buneman waves generated by large electric fields in the E layer (ref. 5 and refs therein).

To compute the efficiency of reflection is a difficult task, but some estimates can be made. If we use equation (1) of ref. 5 for the (power) reflectivity R, a plasma frequency $f_p = \omega_p/2\pi \approx 4$ MHz, a percentage plasma density modulation $|\Delta n/n| \sim 0.1$, and a number of scatterers along the ray path $N \sim 10^4$ m per 40 m $\sim 2.5 \times 10^2$, we find $R \simeq 6\%$, that is a reflectivity high enough for this reflection process to be of possible significance in 'guiding' the 20-MHz radiation into the high latitude night-side. Note that only one or at most two reflections from the ionosphere are required.

It seems of some relevance that, at the time of Riihmaa's observation, the K_p index was 4^-, indicative of polar cap electric fields above the Farley–Buneman threshold. The possibility arises of testing the proposed mechanism by determining whether night-time reception of solar radio bursts occurs preferentially when large ionospheric electric fields exist over the polar cap. Were a correlation to be found, it would be in line with the observed correlation between high intensity polar cap electric fields and the occurrence of the Slant E Condition (SEC) in high latitude ionograms[6,7].

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Why is the Maier–Saupe theory of nematic liquid crystals so successful?

THE Maier–Saupe theory of nematic liquid crystals is founded on a molecular field treatment of long-range contributions to the intermolecular potential and ignores the important short-range forces. Nonetheless this theory is particularly successful in predicting the orientational properties of real nematics. Here we propose a model which accounts both for the success of the Maier–Saupe theory and the failure of theories based exclusively on short-range forces.

The liquid crystal phase of a nematogen is characterised by the long-range orientational order which is destroyed at the transition to the isotropic fluid. The Maier–Saupe theory has been particularly successful in accounting, not only for the order–disorder transition, but also for the orientational properties of the nematic mesophase[1]. The theory is founded on the molecular field approximation applied to a weak anisotropic pair potential; this then gives the effective orientational potential for a single particle as

$$U(\cos\theta) = \bar{u}_2\bar{P}_2P_2(\cos\theta)$$

where θ is the angle between the molecular symmetry axis and the director. The order parameter, $\bar{P}_2$, is the ensemble average of the second Legendre polynomial and $\bar{u}_2$ is a combination of the averaged anisotropic interaction parameters. Because the theory contains just one unknown, $\bar{u}_2$, the change at the transition in the order parameter ($\bar{P}_2^{(K)}$) and the entropy ($\Delta S^{(K)}$) are predicted to be universal properties of the nematogen. This prediction is in reasonable agreement with experiment; in addition the calculated values for $\bar{P}_2^{(K)}$ of 0.43 and $\Delta S^{(K)}/R$ of 0.417 are found to be in quite good accord with the observed values[2,3]. The agreement with experiment can be made perfect by extending the Maier–Saupe theory in a variety of ways. These include the addition of terms to the intermolecular potential to allow for higher rank interactions[4] and deviations from molecular cylindrical symmetry[5] as well as by taking the molecular field approximation to higher order[6].