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〈研 究 論 文〉

비열평형 대기의 원자스펙트럼

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복사전달식, 통계평형식 및 전하-입자 보존식을 동시에 만족시키는 비열평형상태의 대기에 대하여 그 방출원자 스펙트럼을 수치계산하였다. 등온, 등압의 비열평형 대양홍염을 대상모델로 선정하였는데 여기에 적용한 제한조건중 복사전달에 관련된 편 미분방정식은 3점근사 차분법에 의해 정리하였고 홍염중심에 대칭성을 가정하여 경계조건을 부여하였으며 대기의 물리상태에 관련된 비선형 연립방정식의 해는 완전선형화 기법을 통한 퓨트리에 소거법을 이용해 구했다.

계산결과에 의하면 저온의 모델홍염은 복사장 및 입자수의 분포에 있어서 표면근처에 상당히 급격한 변화가 나타났는데 라이만 연속선의 복사온도에 가까운 7,300 K의 홍염에 대해서는 이들 물리량의 내부분포가 총입자수에 관계없이 거의 일정한 것으로 나타났다. 금속의 스펙트럼선 생성에 크게 관여하는 자유전자수는 6,300 K보다 낮은 홍염모델의 경우 표면에서 내부에 걸쳐 상당한 변화가 있다. 그러나 이와같은 저온의 모델은 밀도를 높히더라도 관측치를 설명할 수 있는 정도의 세기를 가진 수소선을 방출할 수 없는 것으로 나타났다.

Cross-Polar Cap Potential Difference, Auroral Electrojet Indices and Solar Wind Parameters

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The cross-polar cap potential difference, Φ (KRM) is estimated from ground magnetic perturbation data through the magnetometer inversion method, combining with a 'realistic' ionospheric conductance distribution estimated from the DMSP X-ray image data. A significant correlation is found between the Φ (KRM) and *AE* (12) index; Φ (KRM, kV)$=36+0.082 \cdot AE(12, nT)$ with the correlation coefficient being 0.80. Φ (KRM) is compared with the potential difference estimated from more direct measurements of the satellite electric field measurement (*Weimer et al.* 1990), and the Φ (IMF) based on solar wind parameters (*Reiff and Luhmann* 1986). Φ (IMF) is found

to be surprisingly highly correlated with Φ (KRM), as Φ (IMF)$=29.8+0.999.$ Φ (KRM), although the Φ (IMF) is systematically larger than the Φ (KRM) by 30kV, suggesting the possibility that the theoretical method overestimates the cross-polar cap potential difference. During steady southward IMF periods during which steady Φ (IMF) is expected, significant fluctuations in Φ (KRM) are observed. Since the decrease in Φ (KRM) appears to be closely associated with enhancements in auroral particle precipitation during the periods, a highly correlative relation between Φ (KRM) and Φ (IMF) cannot be expected unless the phases of substorms are taken into account.

The Sunspot Cycles Revisited

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Among many astronomical observations, the sunspots are one of the most straightforward data obtainable and yet bear plenty of astrophysical meanings to investigate. Including ancient records, these observations would pertain more than a thousand years. Ever since J. R. Wolf's introduction of the sunspot number index in 1848, many different sunspot observations can now be mutually adjusted for consistency of scientifically useful sunspot numbers that now covers for nearly three centuries. Here I describe the discovery of a logn-term modulation of *a period of* 92^{+21}_{-13} *years* with the "time-delay correlation" method on the sunspot data compiled over the last a total of 289 years. This period falls well within the Gleissberg (1971, *Solar Phys.*, **21**, 240.)cycle 80~100 years and clearly contrasts with the 55 year grand cycle which Yoshimura (1979, *Ap. J.*, **227**, 1047.) claimed.

For the origin of the sunspot periodicity, though solar physicists are not now convinced that the Sun follows such a strict periodicity (somewhat *Chaotic* in behaviour), planetary tidal forces on the Sun are simulated over the last 300 years, in which the simulated locations of planets are accurate within 10^{-6} or so. This experiment indicates that there seems no correlation between them. However, positional variations of Sun's barycenter (which period is about 100 years) appear to be somewhat large enough that planetray configurations cannot entirly be ruled out for their being influential on the solar convection: via exerting extra Coriolis forces due to wobbling of the body. Dynamics of this phenomena is currently being undertaken.

Zenith Distance Dependence of the Atmospheric Diffuse Light

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In order to understand the empirically determined distribution of the atmospheric diffuse light (ADL) over zenith distance, we have solved the problem of radiative transfer in an anisotropically