EXPERIMENTAL CHECKING OF THE CHAPMAN-FERRARO THEORY

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According to the Chapman-Ferraro theory (CFT), storm-time depression is determined as $Dst = DCF + DR$ where $DCF = \chi\sqrt{8\pi P_{dyn}}$ is the geomagnetic effect of the magnetopause current, P_{dyn} is the solar wind dynamic pressure, χ is the coefficient, depending on the magnetopause form. There are some experimental facts which contradict this theory. First, Mead's calculations give $\chi = 0.52$, whereas experiment yields $\chi = 0.27$. The difference is generally explained by the ring-current influence. Thus, the ring-current effect is included twice to the CFT. Second, the CFT predicts the magnetic field in the subsolar point B_S to be at least factor 2 greater that the dtpolar field B_d, i.e $B_S \geq 2B_d$, while storm-time observations give $Bs \approx B_d$. Third, during storm the dayside magnetopause removes to the earth much closer than it follows from Mead's calculations. Fourth. it is impossible to interpret the equatorward shift of the auroral oval with *Dst* growth in terms of the CFT, Fifth, the CFT fails to explain the immediate response of the *Dst* to the southward IMF, which is observed in experiment,

We suggest to use the more accurate expression

$$Dst = \sqrt{8\pi p} + DR - F/2S$$

where p is the solar wind pressure in the stagnation point, $S = \pi r_S^2$ is the equatorial cross-section of the stable trapping region which boundary goes along the contour $B = B_S = \sqrt{8\pi p}$; r_S is the radius of this boundary approximately equal to the stand-off distance, F is the magnetic flux beyond the stable trapping region. The southward IMF transfers geomagnetic field lines from the dayside to the magnetotail thus increasing F, widening the auroral oval, and strengthening *Dst*. Radius of the stable trapping region can be found from the equation

$$r_S\left(\pi r_S^2\sqrt{8\pi p} + F\right) = 3\pi(M_E + M_{RC})$$

where M_E and M_{RC} are the magnetic dipoles of the earth and ring current respectively. Growth of the flux F leads to the decreasing to r_S that is to erosion of the dayside maagnetosphere. All the five observations listed above which are not in agreement with the CFT can be quantitatively described by our theory.