INTENSITY GRADIENT OF THE GREEN CORONAL LINE AND CORONAL HOLES

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ABSTRACT. From the widely used model of the coronal hole by Kopp and Or-
rall (1977) and from the theory of the exitation equilibrium of coronal ions
followes, that the gradient of the intensity of the coronal green line is hig-
her into the coronal hole as outside the one. However,the measurements shows
contradictory results. It is possible explain the discrepancy with the hypo-
thesis, the distribution of the electron density into the coronal hole is dif-
ferent than by the accepted model.

ГРАДИЕНТ ИНТЕНСИВНОСТИ ЗЕЛЕНОЙ КОРОНАЛЬНОЙ ЛИНИИ И КОРОНАЛЬНЫЕ ДЫРЫ. Из
ощепринятой модели корональной дыры по Коппу и Орраллу (1977) и из теории
эксцитации корональных ионов плынет, что градиент интенсивности зеленой коро-
нальной линии должен быть большим в корональной дыре, чем вне нее. Измерения
дают противоположный результат. Расхождение эксперимента с теорией можно объ-
яснить предполагая, что расспределение электронной плотности в корональной ды-
ре не соответствует принятой модели.

GRADIENT INTENZITY ZELENEJ KORONÁLNEJ ČIARY A KORONÁLNE DIERY: Zo vše-
obecne prijatého modelu koronálnej diery, ako ho uvádzajú Kopp a Orrall (1977)
a z excitačnej rovnováhy koronálnych iónov vyplýva, že gradient intenzity ze-
lenej koronálnej čiary je väčší v koronálnej diere, ako mimo nej. Merania však
ukazujú výsledky práve opačné. Rozpor sa dá vysvetliť predpokladom, že rozde-
lenie hustoty nad koronálnou dierou je odlišné od prijatého modelu.

Since coronal holes (CH) were first observed on Skylab, it has been assumed that these are very probably the source of high-velocity solar wind streams which are, in turn, responsible for geomagnetic storms. If this is true, this fact is considerable prognostic importance and, therefore, we have attempted to find a simple parameter which we could use to distinguish the CH's from their environment. This parameter should be observable from the Earth, because X-ray pictures of the Sun are not available.

In this study we have attempted to find out whether the intensity gradient of the green coronal line in the CH is different from that elsewhere. According to the generally accepted model (Kopp and Orrall, 1977) the conditions in the CH and outside it are as shown in Tab. 1.

Table 1

CORONA

	outside CH	in CH
T	$2.0 \times 10^6 K$	$1.5 \times 10^6 K$
	n_e cm^{-3}	
1.1	1.6×10^8	5.4×10^7
1.2	7.1×10^7	1.6×10^7

The intensity gradient of the green coronal line is defined by the relation.

$$G = - \Delta \log I / \Delta \varphi$$

where φ is expressed in minutes of arc. Measurements indicate that its value differs but little from 0.3.

Using the model parameters and the theory of ionization and excitation of coronal ions, as well as the most recent values of atomic paramaters, we then determined the values the gradient should have in the CH and outside it. We arrive at 0.38 in the former and 0.29 in the latter case.

We checked this result against observations which were made at the coronal station of Lomnický Štít in 1966 to 1973. We found that the character of the dependence was quite the opposite. In the region of the CH's, the mean value of the gradinet was found to be about 0.15, elsewhere 0.35.

This variance can be explained in different ways, however, the most probable explanation is that the distribution of the electron density with altitude is different from that in the model, i.e. the decrease of the density with altitude would have to be smaller in the CH and larger outside it. However, this would mean that the flow in the CH has a smaller velocity than in the surrounding regions. But this contradicts the asumption that CH's are the source of high-velocity solar wind streams.

Evidently, the problem of forming of high-velocity streams in the corona will require further study. It is possible that the high-velocity solar wind stream is an extension of coronal rays.

REFERENCES

Kopp, R.A., Orrall, F.Q.: 1977, Coronal Holes and high speed wind streams (ed. J.B. Zirker) Colorado associated university press.

DISCUSSION

G.B. Gelfreikh
К каким высотам короны относятся Ваши определения градиентов интенсивности зеленой корональной линии ?

M. Rybanský
Определения относятся к высотам от 1,1 по 1,2 радиуса Солнца.

M.A. Mogilevsky
Речь шла о корональных дырах высокоширотных или низкоширотных ?

M. Rybanský
Говорилось о экваториальных корональных дырах.