Publ. Obs. Astron. Belgrade No. 53 (1996), 21 *Invited lecture*
Приглашенный доклад

INFLUENCE OF WEAK D.C. MAGNETIC FIELD ON THE H_β LINE EMITTED FROM T-TUBE PLASMA

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The influence of a magnetic field on the emission of the Balmer H_β line in a T-tube was investigated.

Magnetic field are always present in astrophysical and fusion plasmas. The magnitude of the fields in these plasmas ranges from a few tents of a Tesla up to a few million Tesla in certain astrophysical plasmas. In general, investigations of the influence of the magnetic field on hydrogen line emissions from the plasma deal with Zeeman effect in laboratory as well as in astrophysical plasmas or the so colled $\mathbf{v} \times \mathbf{B}$ shift in neutral beams in tokamak plasmas.

Here we present experimental results of the influence of magnetic fields on the emission of the hydrogen H_β line. The plasma source was a small electromagnetically driven T-tube. Applied magnetic fields were 0.5 T and 2.1 T. The experiments were performed in the electron density range of (2.3 - 7.8) $\times$ 10^{23} m^{-3} and in electron temperature range of (19400 - 34500) K. We have detected a small red-shifts of the H_β line emitted parallel to the magnetic field lines in comparison to the same line emitted without magnetic field. The measured shifts are small, in the range from 0.05 nm to 0.3 nm. In some cases, the shift lies within the estimated error limits. The measurements were performed several times and the shifts were always detected and noticable.

In order to indentify possible effects which could influence the line profile we checked the effect of a frozen magnetic field in the plasma and contribution of the Zeeman effect. Calculations of the magnetic line diffusion length show that the magnetic field was always present in the plasma during the measurements. The contribution of Zeeman effect was negligible in comparison to the Stark effect due to rather weak applied magnetic field. The plasmas was moved along the T-tube axis with velocity perpendicular to the magnetic field lines. The magnetic Lorentz force caused deflection of charged particles, electron and ions. The separation of charged particles caused an additional anisotropic electric field perpendicular to $\mathbf{v}$ and $\mathbf{B}$. This field could be responsible for additional red shift of H_β line.