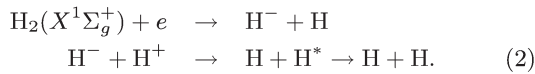
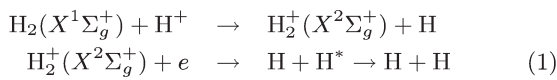


§27. Construction of Neutral Transport Code for Hydrogen and Deuterium Plasmas

Sawada, K., Suzawa, Y., Kubo, T., Ueda, M. (Shinshu Univ.), Nakamura, H.

We are constructing collisional radiative models for atomic and molecular hydrogen and a neutral transport code in order to understand the hydrogen recycling in the LHD edge plasmas.

Our code includes the processes of the molecular assisted recombination:



The effective rate coefficients of the processes strongly depend on the initial vibrational and rotational states of the molecular hydrogen [1,2]. In our collisional radiative model of molecular hydrogen and the neutral transport code the vibrational levels are distinguished. In this study, we have modified the codes to give the

rotational temperature as input parameter. In addition, we have constructed corona model for the fülcher band ($d^3\Pi_u \rightarrow a^3\Sigma_g^+$) of molecular hydrogen to determine the rotational and vibrational temperatures of the ground electronic state from measured spectra of the band. The Lyman and the Werner bands of molecular hydrogen can also be used for the purpose. However, the effect of the radiation trapping should be included appropriately for the bands.

In order to test the code for the fülcher band, we have applied the code to our RF(13.56MHz) plasmas of Shinshu University. We measured the fülcher band and determined the rotational and the vibrational temperatures which reproduce the fülcher band spectra best. Figures 1(a) and 1(b) show the experimental spectra and the reproduced spectra by the model, respectively. The determined rotational and vibrational temperatures were about 475[K], 5500[K], respectively. The vibrational temperature evaluated from the calculated population distribution of the vibrational states by the neutral transport code was about 2000[K]. The experimental value was larger than the calculated one. The difference may come from the negligence of the vibrational excitation of molecular hydrogen by the impact of neutral hydrogen atoms which are produced from molecular hydrogens by the Franck-Condon process.

- 1) Sawada, K., J. Plasma Physics, **72**, (2006) 1025.
- 2) Horacek, J., Houfek, K., Cizek, M., Murakami, I., Kato, T., NIFS-DATA-73, (2003).

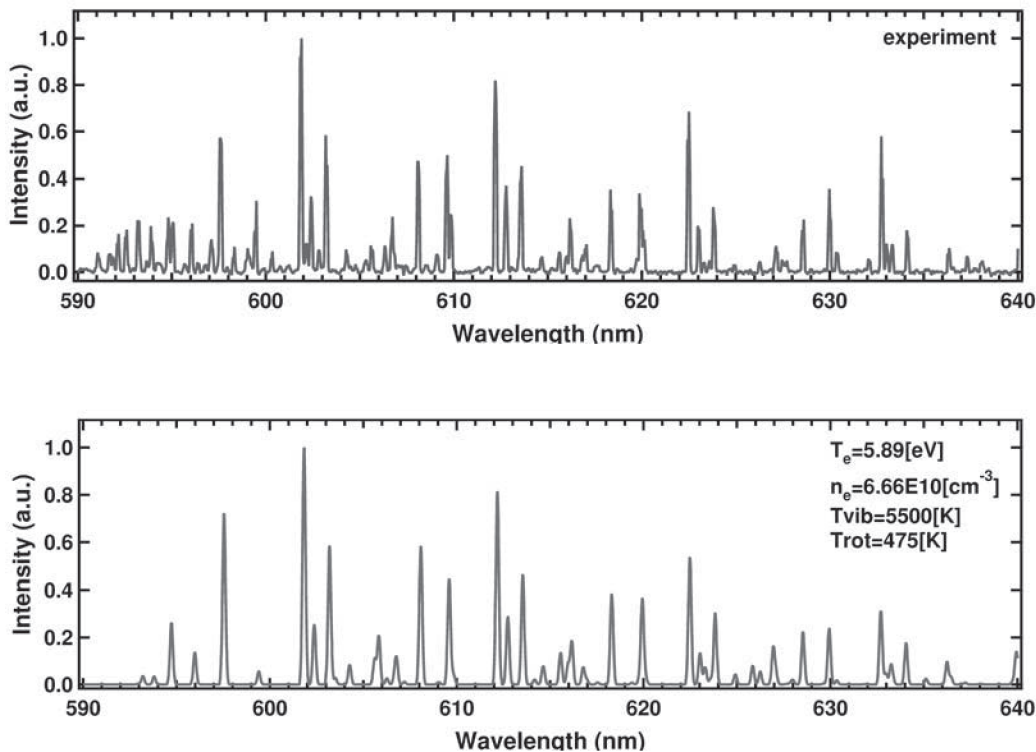


Fig.1. Fülcher band emission. (a) experiment. (b) calculation.