STSM scientific report

Title project: CCD study of electron induced reactions in N2-CH4 discharges
Grantee: Gabriel Horvath
Host: Frantisek Krcma
Period from 14/05/2010 – 30/06/2010
COST STSM Reference Number: **COST-STSM-CM0601-05652**
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- **Purpose of the visit**

My short term scientific visit was focused on the optical emission spectroscopic (CCD) study of a packed bed DBD discharge fed by various gas mixtures of CH_4 with N_2 operated at room temperature and atmospheric pressure at fixed flow rate of 200sccm. The positive and negative systems of nitrogen and presence of CN, with weak bands of H^{β} lines have been expected from the measurements. Primitive organic radicals and excited states of nitrogen/CN species have important role in the interstellar medium..

- **Description of the work carried out during the visit**

A schematic diagram of the experimental set-up is shown in Fig. 1. The packed bed DBD discharge chamber was sealed and equipped by a sapphire view port for CCD measurements. The measurements have been conducted in flowing regime at a fixed flow rate of 200 sccm. The gas mixture ratios CH_4:N_2 and total flow rate was regulated using MKS mass flow controllers. The electrodes of the DBD discharge reactor have had a standard coaxial geometry but the electrode gap was filled with glass spheres. The discharge was operated at voltages 20 and 22 kV peak-to-peak and frequency 13.1 kHz using a power supply system consisted of an oscillator, a Behringer amplifier and a homemade transformer. The voltage was monitored by a digital Tektronix oscilloscope using a Tektronix HV probe and the current was measured by a classical Rogowski current probe.

During the experiments recording optical emission spectra of DBD plasma and its dependence on the CH_4 molar ratio (in rage from 0.5 to 2 % CH_4 in N_2) was investigated.

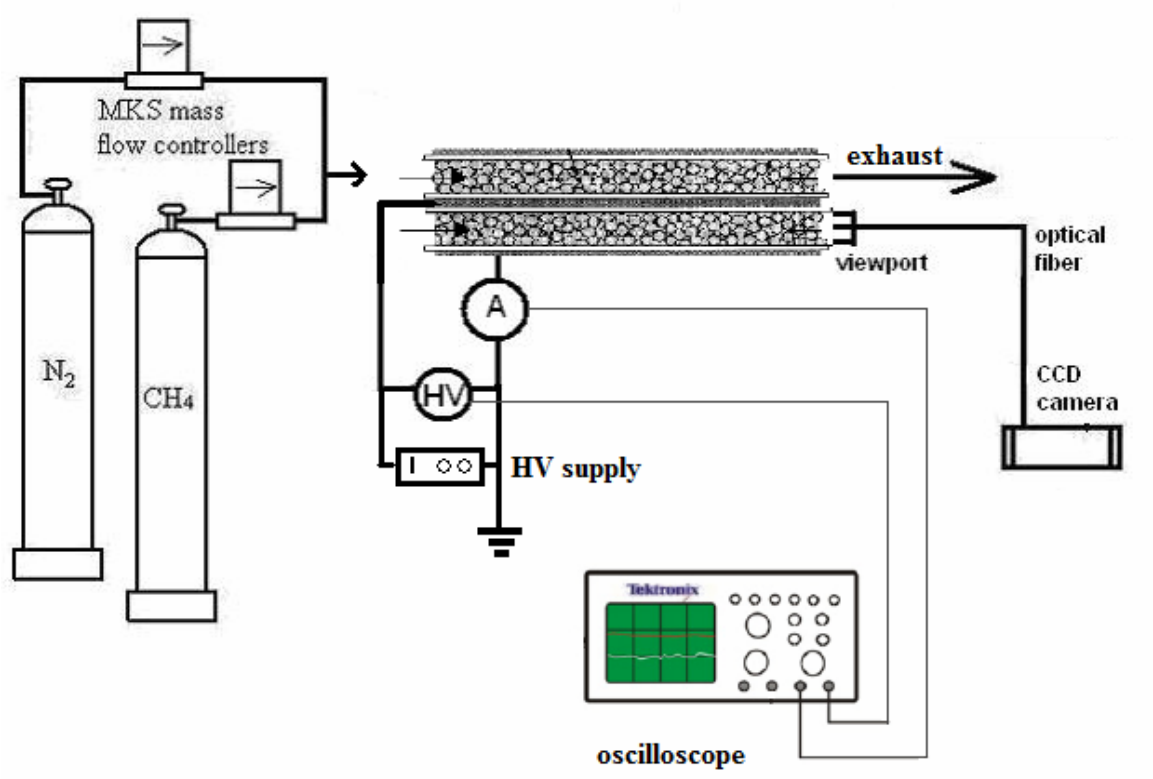

Fig. 1. Scheme of the experimental apparatus.

- **<u>Description of the main results obtained</u>**

CCD spectrometric study of products formed in a packed bed DBD discharge fed by a various mixture of CH_4 in N_2 (0.5, 1, 1.5 and 2 % of CH_4) was carried out in a flowing regime at 200 sccm, at room temperature and atmospheric pressure. According to our results (and in good accordance with earlier FTIR study) intensive lines of CN and the second positive/first negative systems of nitrogen have been found to be the most dominant at their characteristic ranges of wavelength (Fig 2-3).
From measurements was evident, that with increasing CH_4 content the CN line intensity also increased. Deeper analysis will be provided in publications.

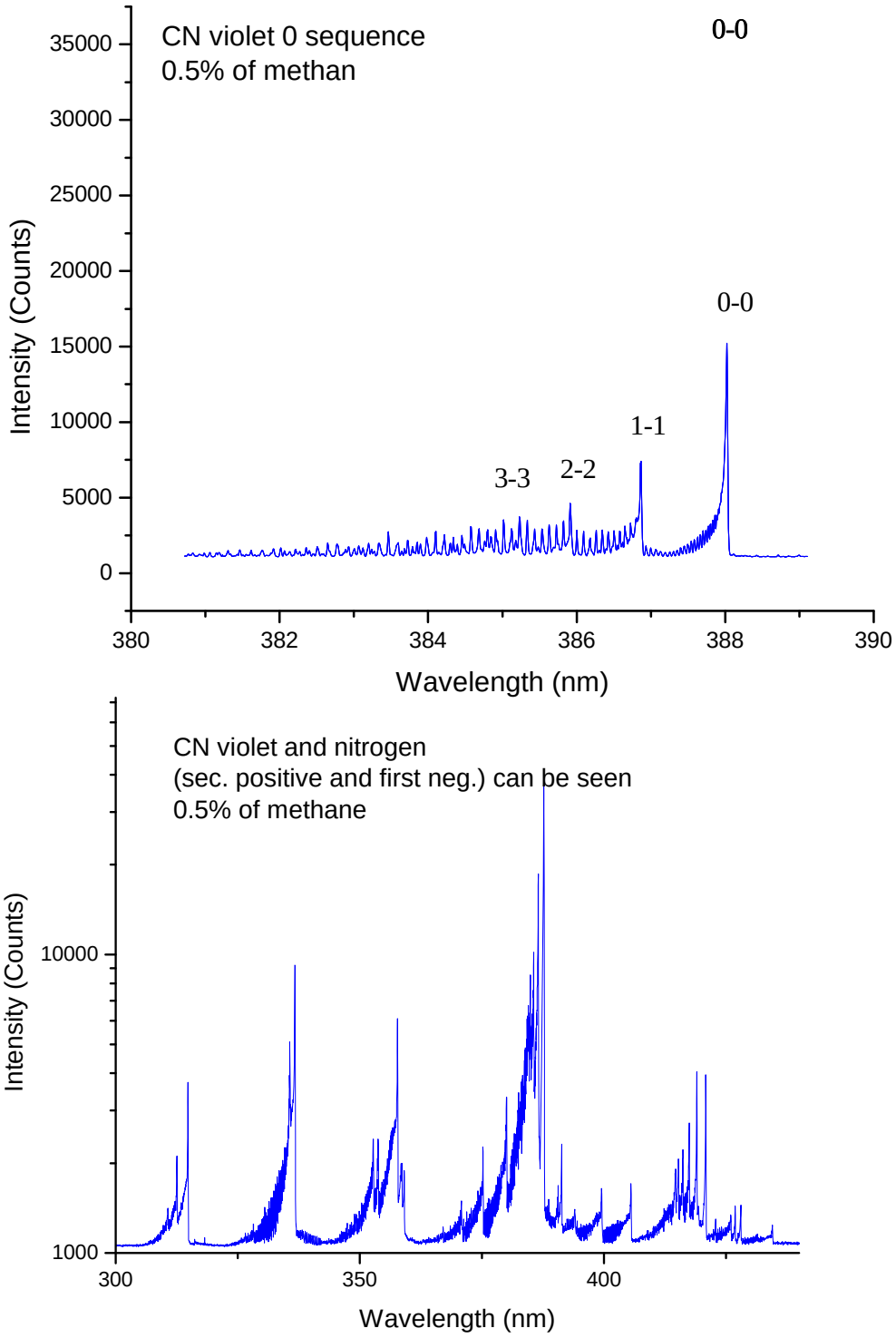

Fig 2. Sample CCD spectra recorded at chosen range of wavelength in mixture of 0.5% of CH_4 in N_2 at 22 kV pk-pk.

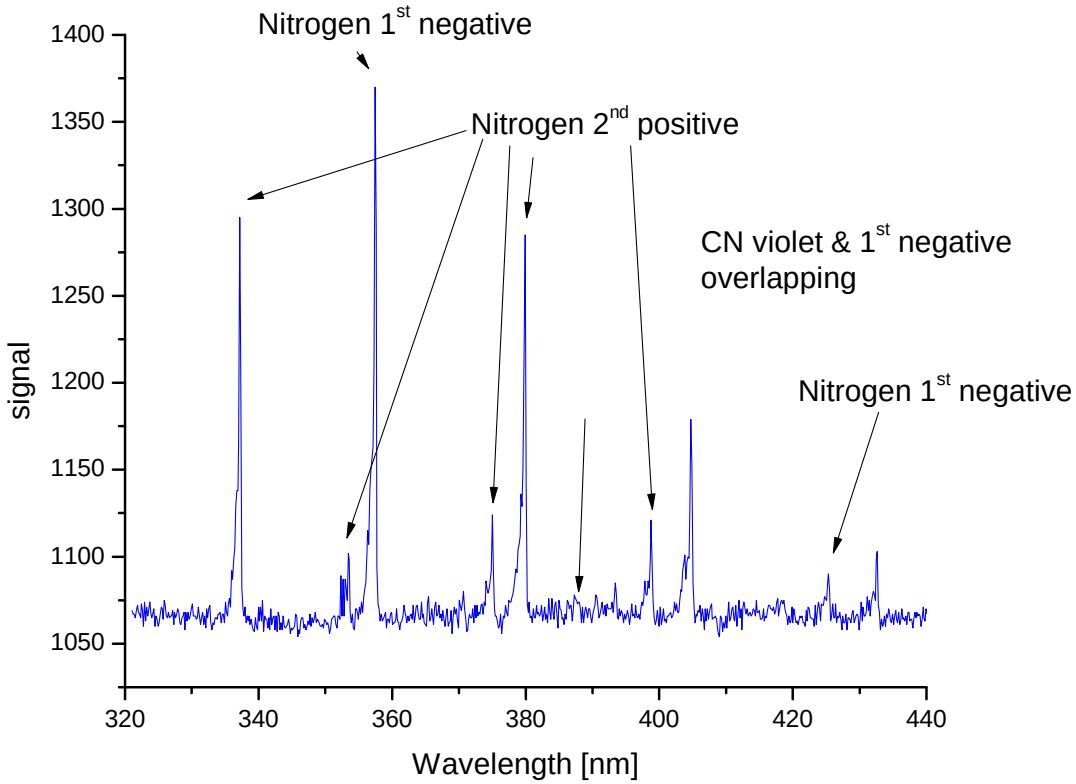

Fig 3. Sample CCD spectra recorded at chosen range of wavelength in mixture of 0.5% of CH_4 in N_2 at 17 kV pk-pk.

- **<u>Future collaboration with host institution (if applicable)</u>**

  Future visit at the host institute is planed at the end of the second half year 2010. The main aim of these visits is a study of organic plasma chemistry in discharges using GC-MS and optical emission spectroscopy.

- **<u>Projected publications/articles resulting and to result from the STSM</u>**

  The results obtained in glid arc discharge are planed to be published in PSST and EPJ-D journals.