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Photolysis-free two photon laser induced fluorescence of H atom

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Abstract
Investigation of H atoms is highly demanded in the combustion environment since they are present in every chemical reaction which involves hydrocarbons. Optical detection of H atoms is difficult because the wavelength which is needed for the excitation is in the vacuum-UV region, where air is absorbing strongly. To overcome this problem two-photon excitation methods have been developed. Following the 2-photon excitation from n=1 to n=3 state the H atom emits fluorescence at the wavelength 656 nm. The use of fs-laser pulses benefits when it comes to the detection of species which might suffer from interfering photodissociation. The experiment was conducted where no difference in TPLIF (two-photon laser induced fluorescence) line profiles received for different laser output energies was found. This clearly indicates the absence of photolytically produced hydrogen atoms. TPLIF has many advantages, this technique allows imaging of atomic species in the premixed flame environment with high temporal and spatial resolution. The present investigation was conducted in a welding torch flame of 1.5 mm diameter, precisely at the tip of the flame. The experiment revealed that the concentration of H atoms at the top of the flame is lower than at the edges of the flame. It should be mentioned that LIF signal might suffer from SE (stimulated emission). Further investigations should be conducted in order to investigate the impact of SE on the signal.

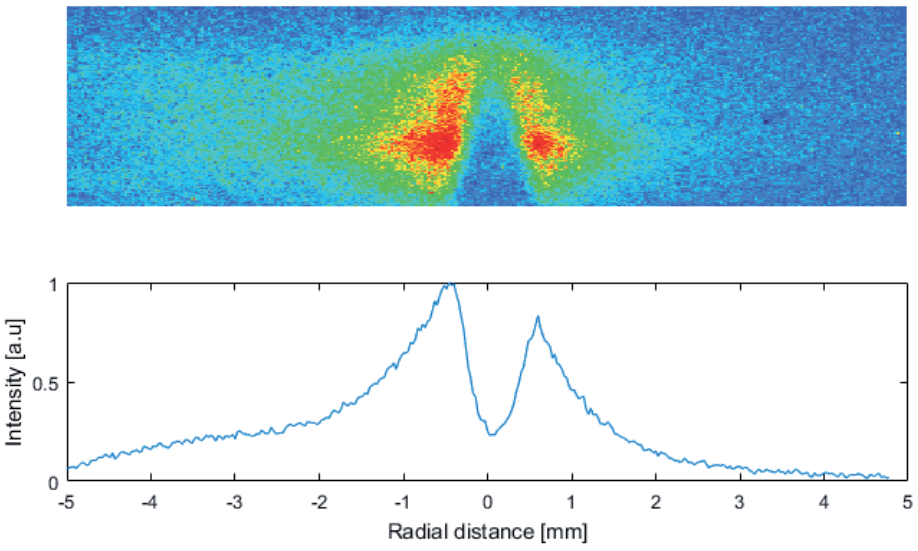

Figure 1. TPLIF image of H atom fluorescence signal on a tip of CH4/air flame (Φ= 1.3), where the laser sheet is 7 mm height.