

Introduction

Background

- NH is a good marker for heat release rate (HRR) in $\text{NH}_3\text{-H}_2$ flames
- Exciting NH radical using $A^3\Pi-X^3\Sigma^-(0-0)$ band has a higher efficiency than (0-1) band[1]

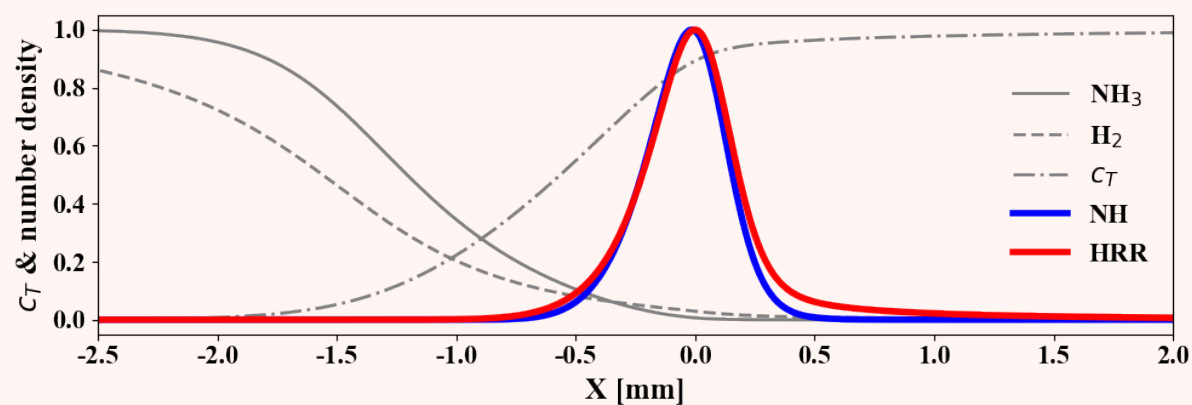


Figure 1 Simulation of free propagated $\text{NH}_3\text{-H}_2$ flame: Comparison of NH and HRR ($\phi = 0.8$, $\text{H}_2:\text{NH}_3=2:8$)

Objective

- Continuous high-speed visualization of NH radical
- Simultaneous high-speed NH-PLIF and PIV

Experimental Setup

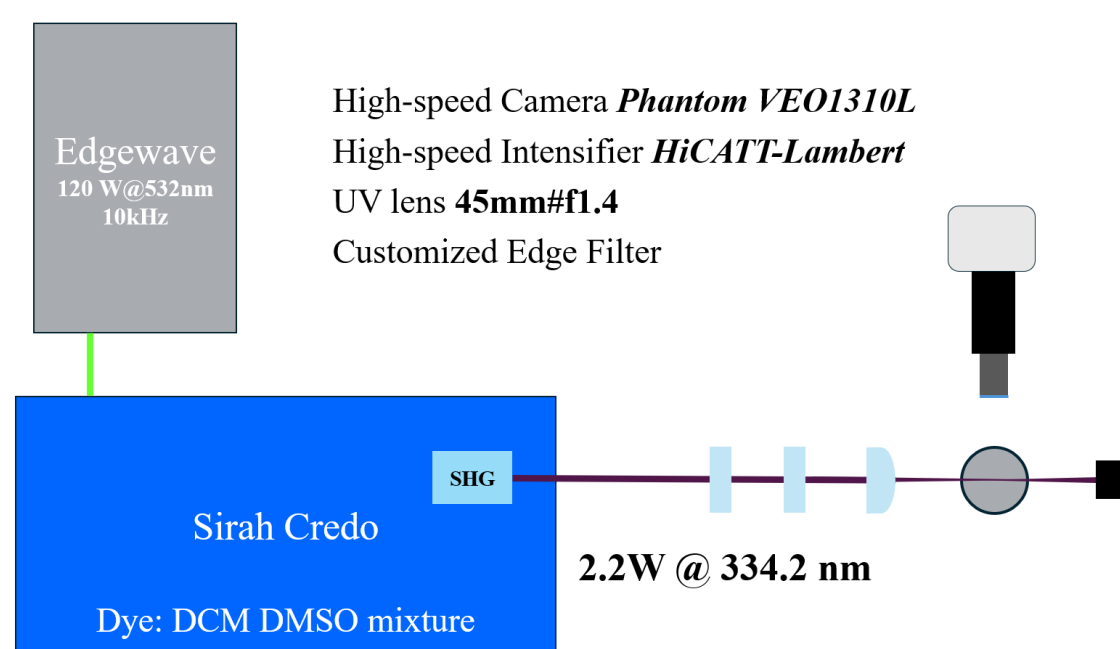


Figure 2 Experimental Setup

Excitation Spectra of NH

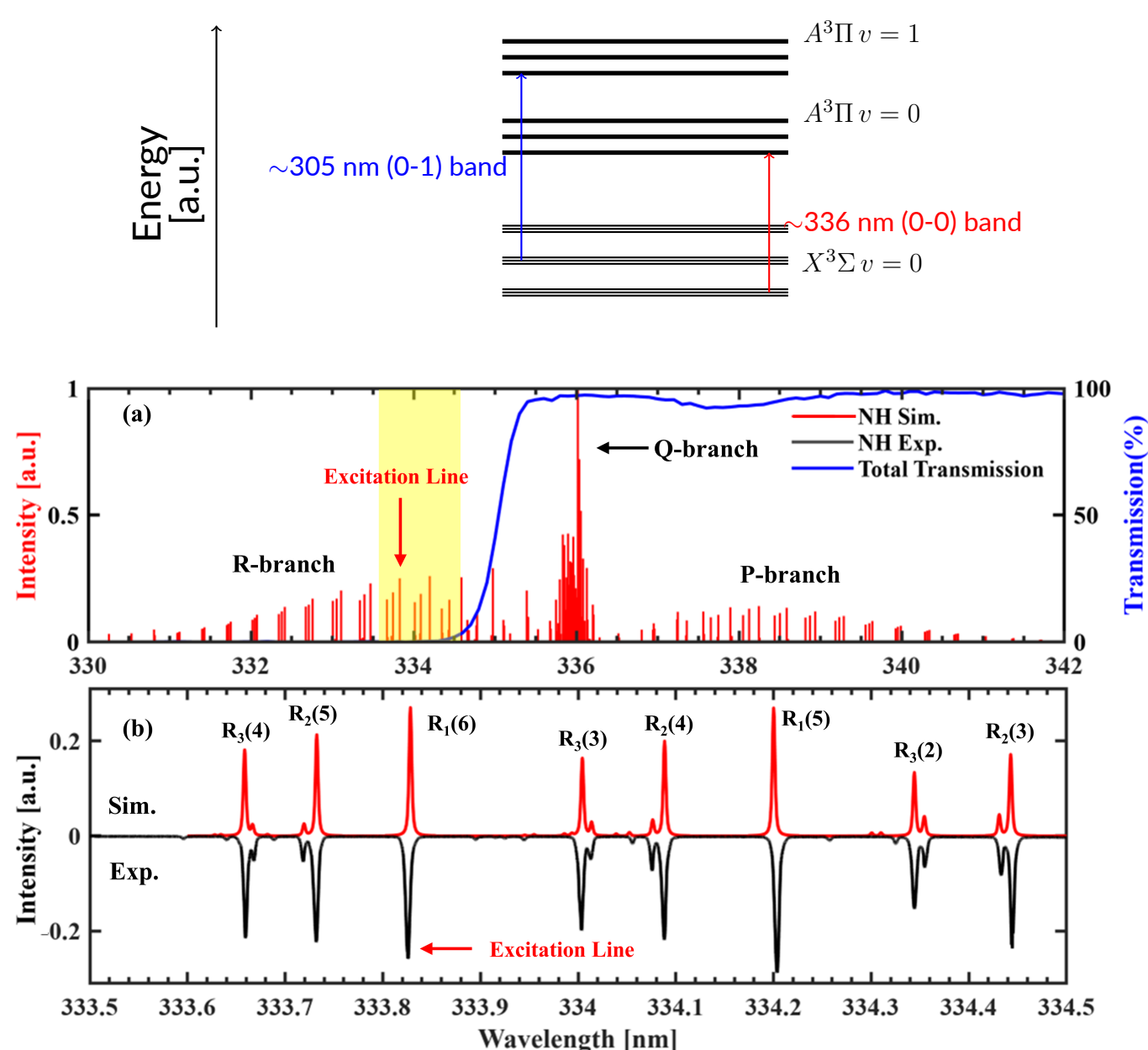


Figure 3 (a) PGOPHER[4] simulation of NH excitation spectrum (red) and filter transmission (blue). (b) Comparison of simulated and experimental excitation scan spectra in the highlighted wavelength range. The NH excitation scan was performed from 333.5 to 334.5 nm with a step resolution of 0.1 pm.

Results

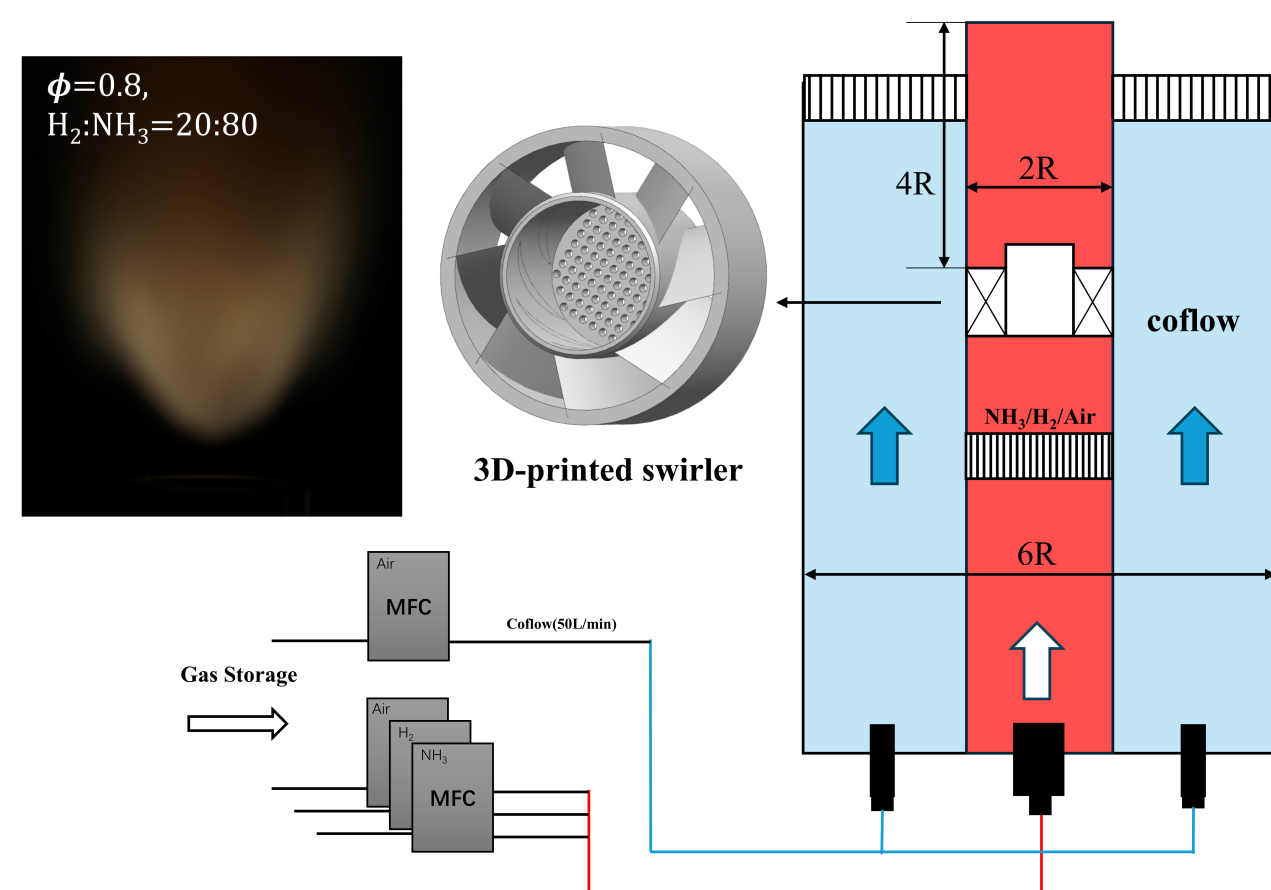


Figure 4 Low swirling burner and flame photograph

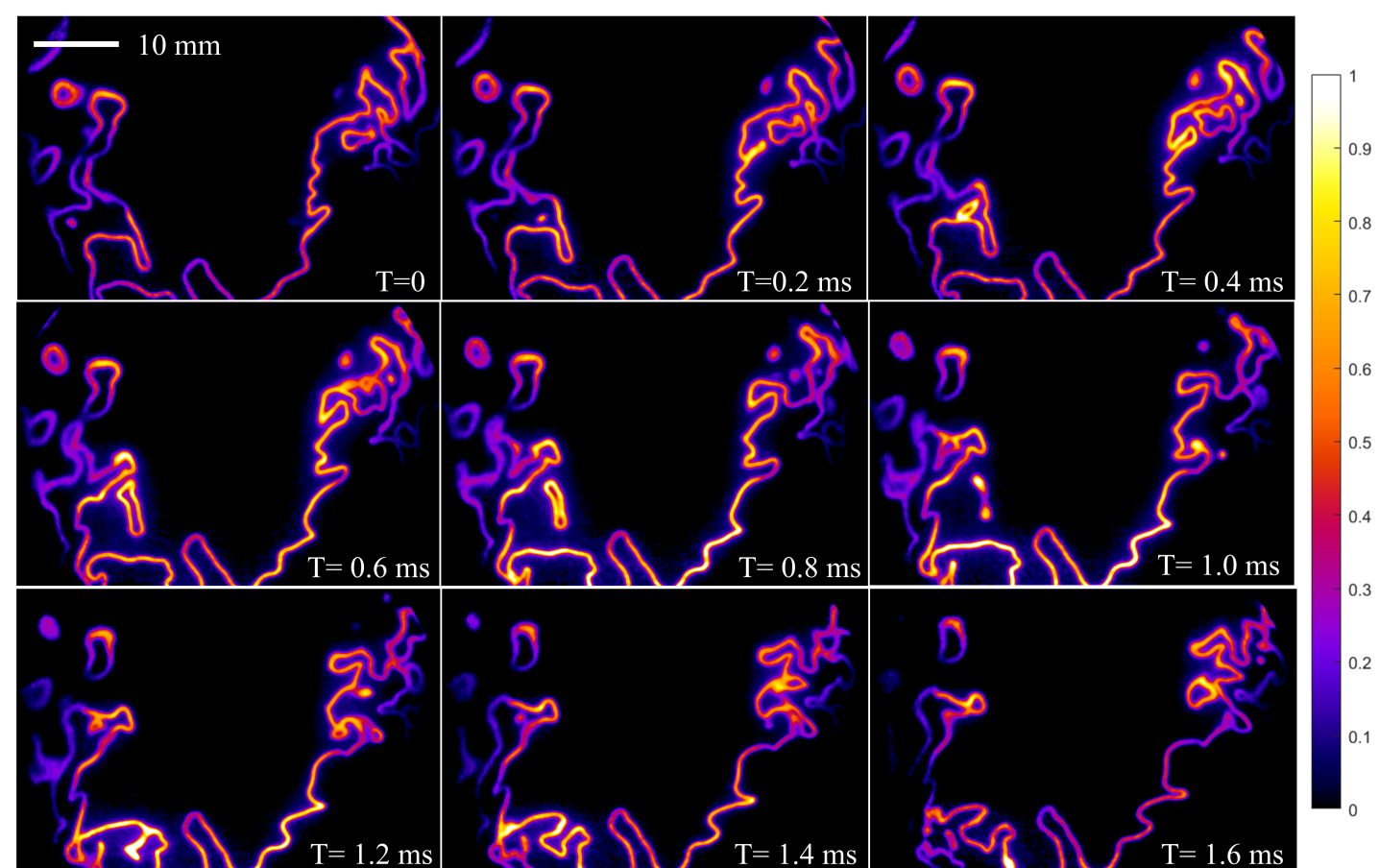


Figure 5 The temporal evolution of a $\text{NH}_3\text{-H}_2\text{-air}$ low-swirling flame acquired at 10 kHz and displayed with 0.2 ms time interval. An excellent SNR of 30 was obtained.

Conclusions

- This work achieves high-quality visualization of high-speed NH-PLIF signals using a commercial high-speed Nd: YAG-pumped dye laser system and a sharp edge imaging filter.
- The demonstrated capability offers a significant opportunity for simultaneous high-speed NH/OH-PLIF and PIV, which is essential for investigating turbulence-flame interactions.

References

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