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# Chemiluminescence in Premixed Ammonia-Air Flames

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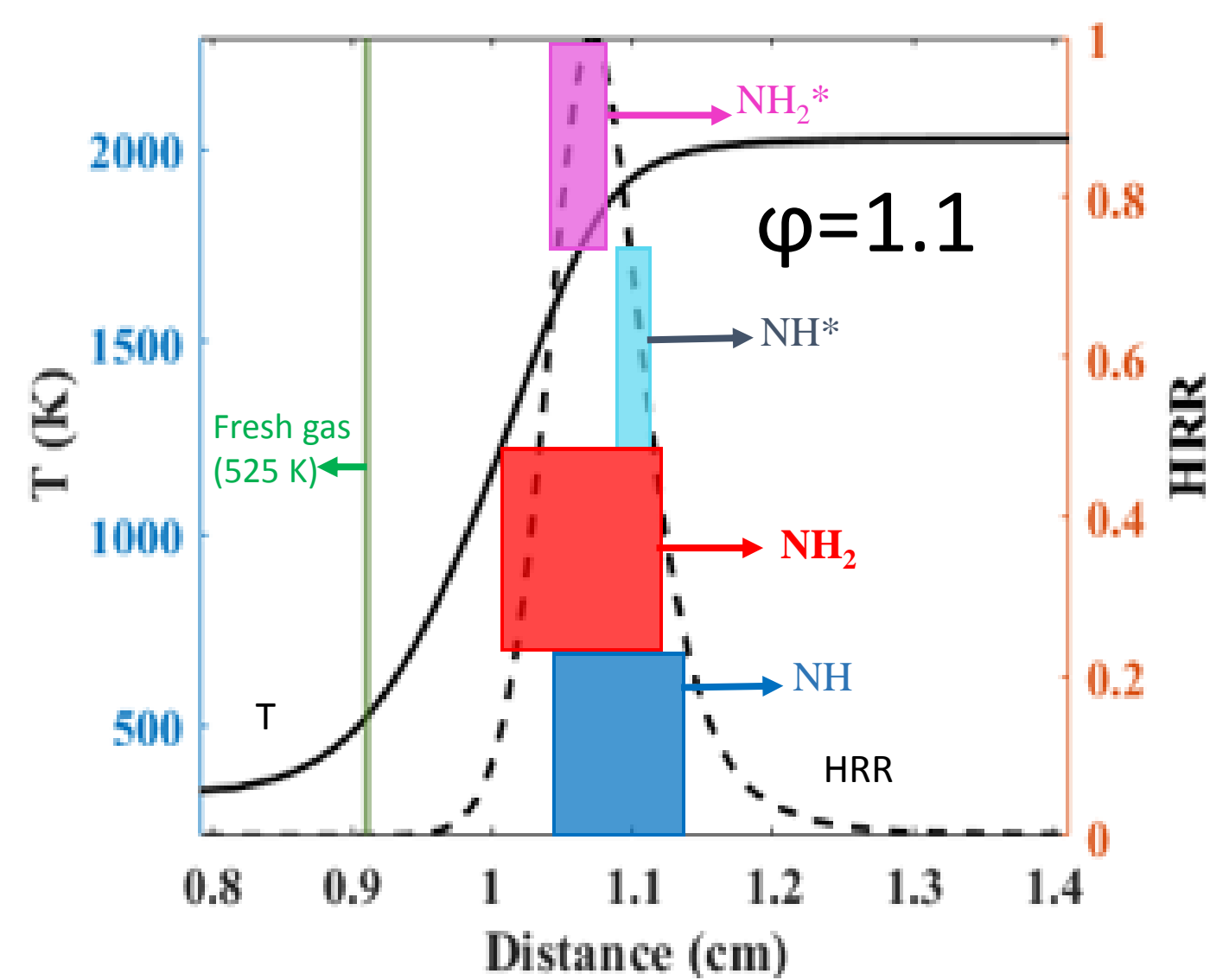
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Ammonia combustion is of great interest as it is a zero-carbon fuel and has a high octane rating. However, the flame properties have not been studied well. The objective of this work is to use an economic diagnostic tool to obtain useful data.

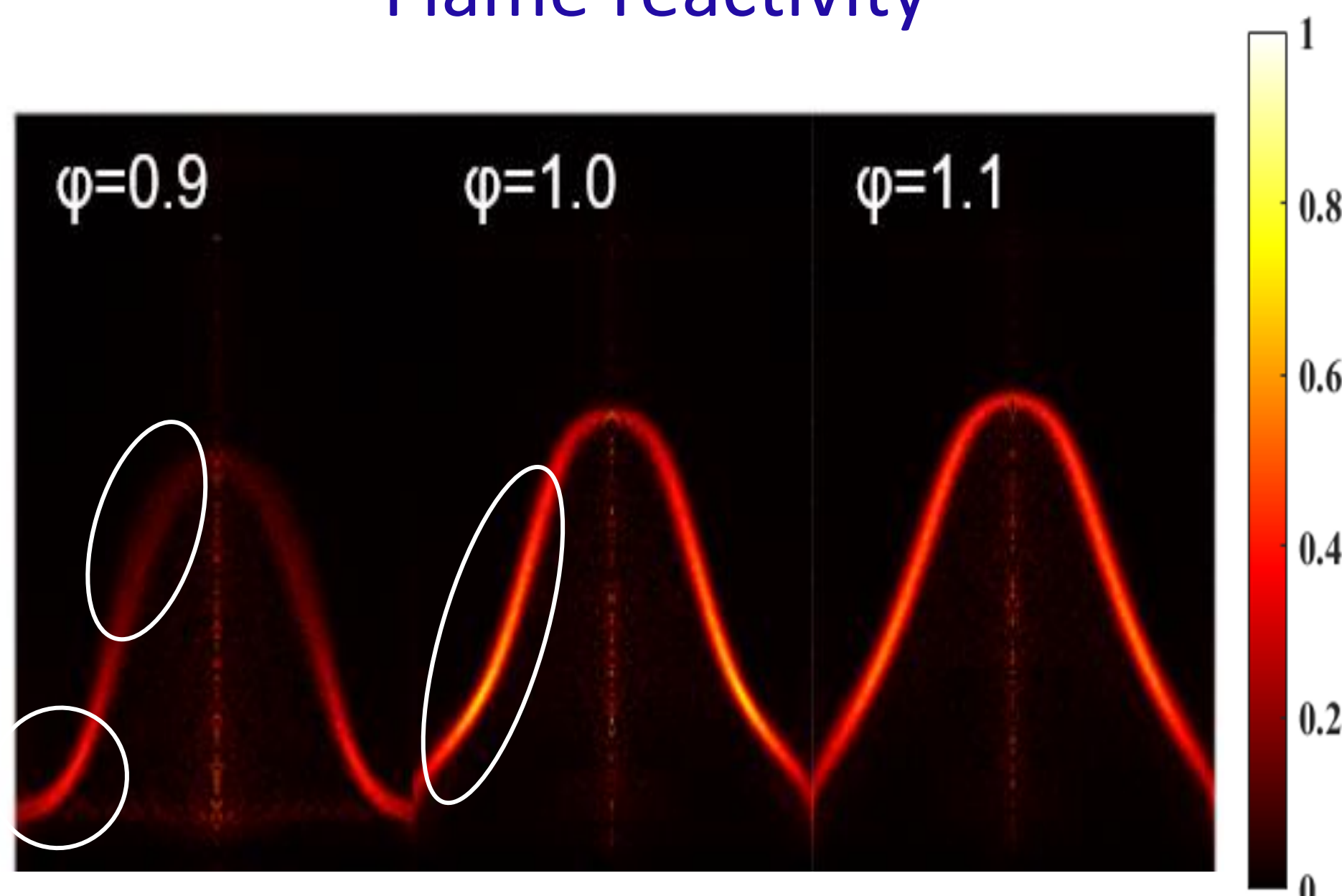
Chemiluminescence is a cheap and non-intrusive diagnostic tool that is widely used to obtain a large range of information pertaining to flame behaviour. In ammonia combustion,  $\text{NH}_2^*$ ,  $\text{NH}^*$ , and  $\text{OH}^*$  have been identified as species of relevance.

## Heat release rate marker



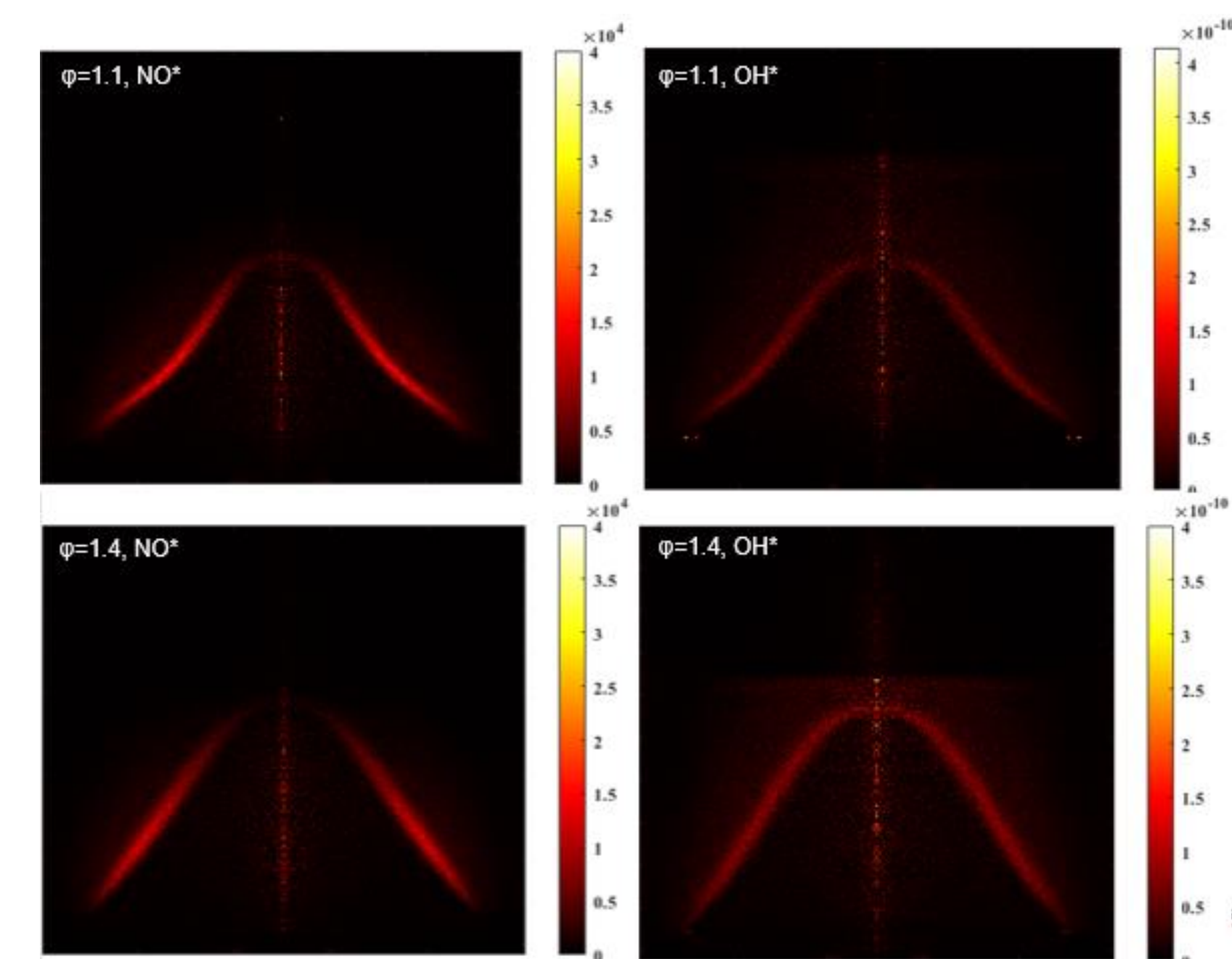
$\text{NH}^*$  and  $\text{NH}_2^*$  have been identified as the HRR marker pure ammonia flames on a Bunsen burner configuration.

## Flame reactivity

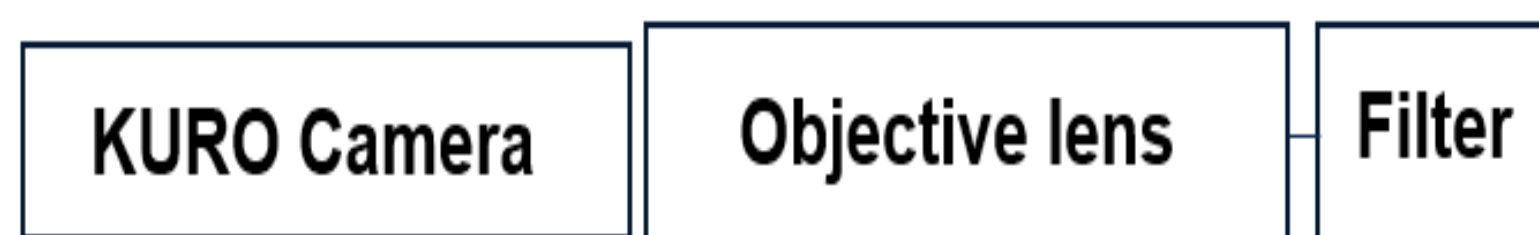


Change of intensity in  $\text{NH}_2^*$  profiles on a Bunsen burner configuration indicating local change of reactivity.

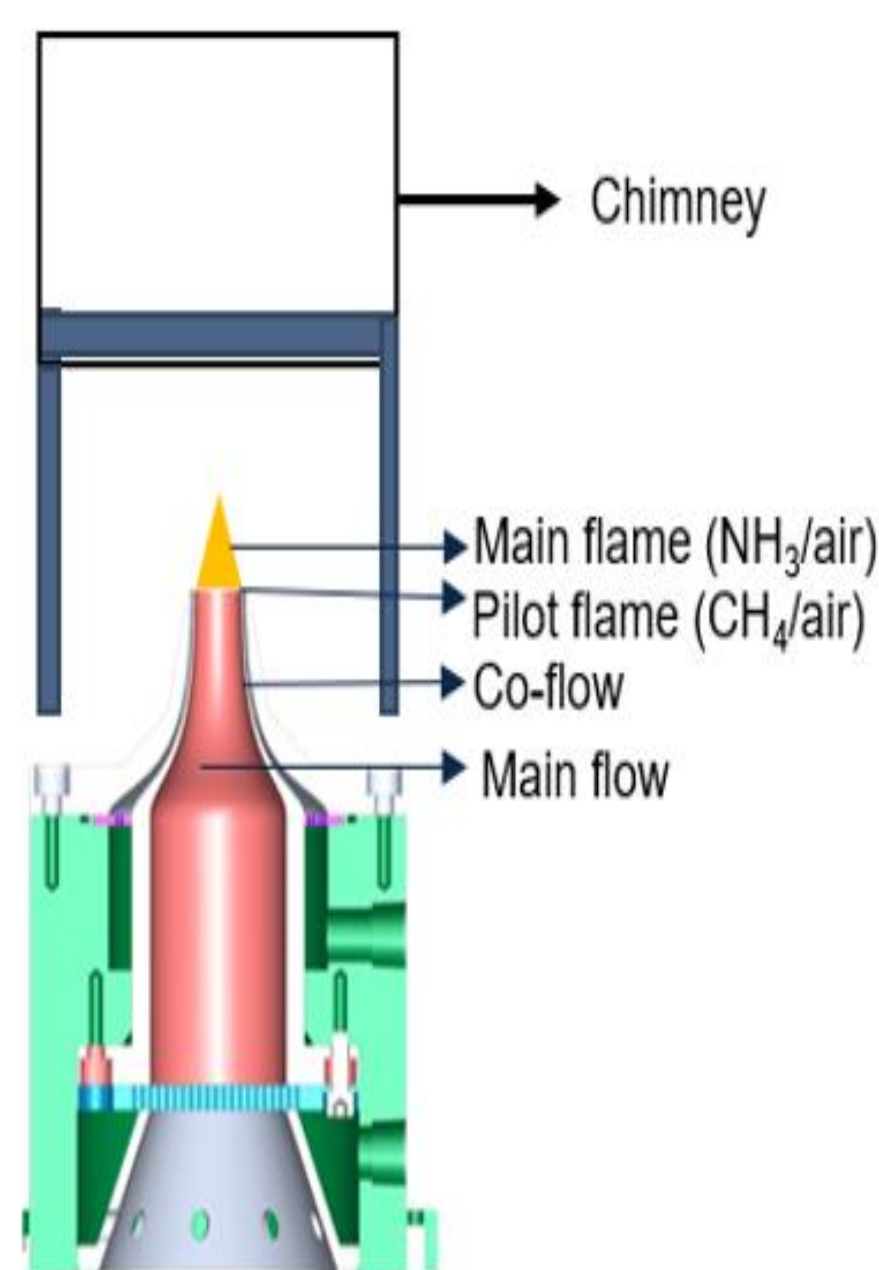
## NO emissions



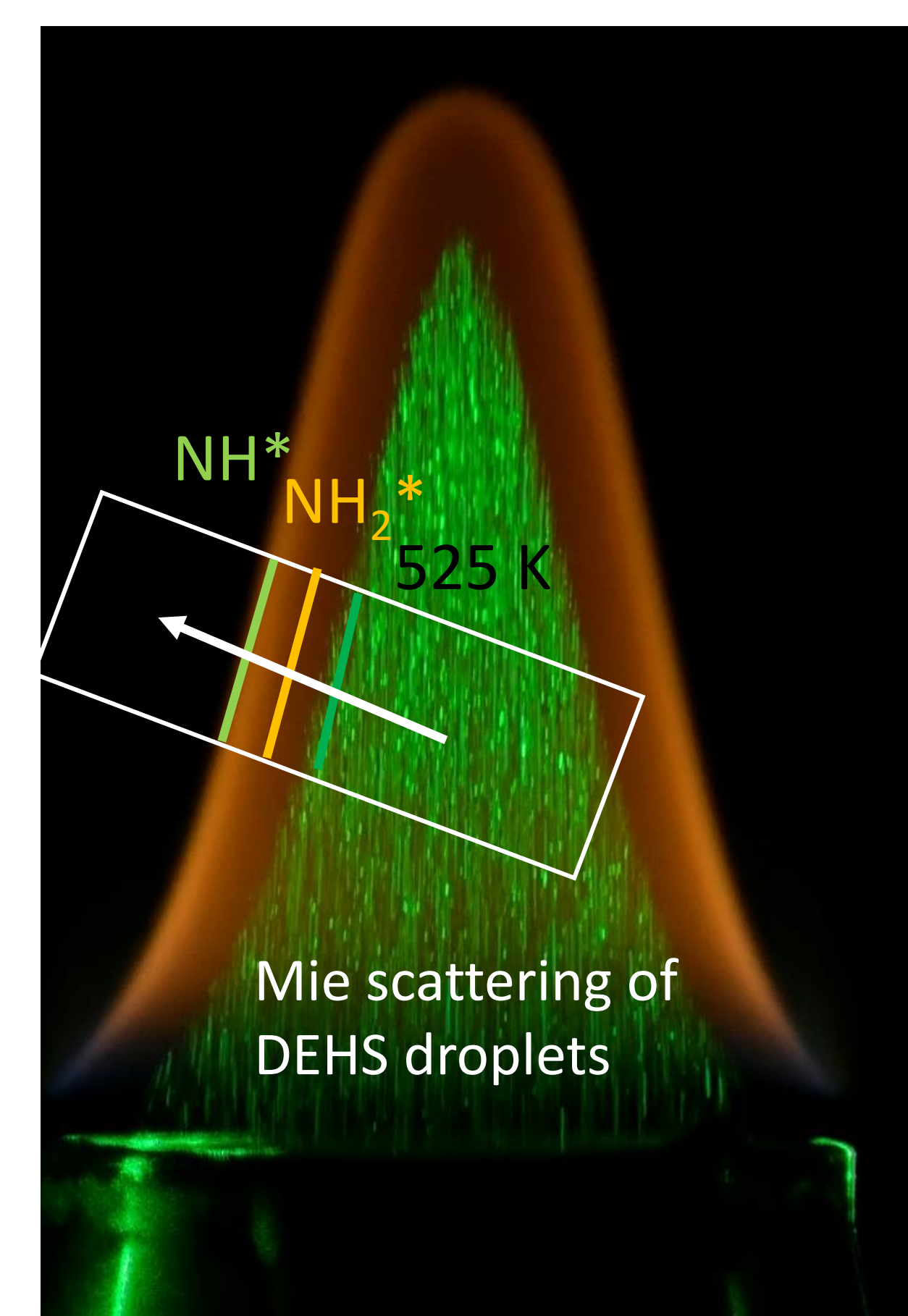
Relative  $\text{NO}^*$  emissions vs corresponding proportional  $\text{OH}^*$  emissions for two different equivalence ratios indicating  $\text{OH}^*$  predictions for relative  $\text{NO}$  quantities



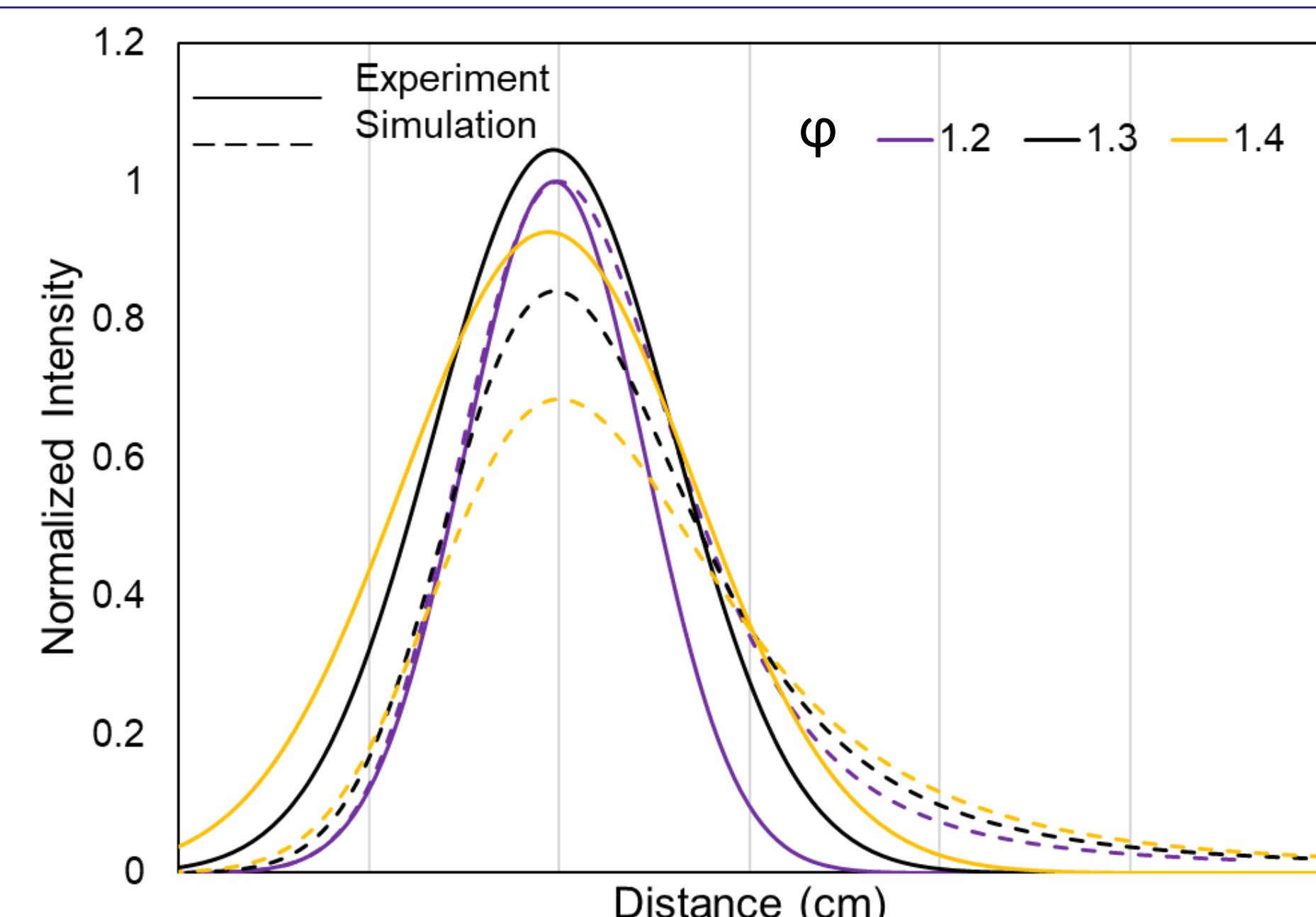
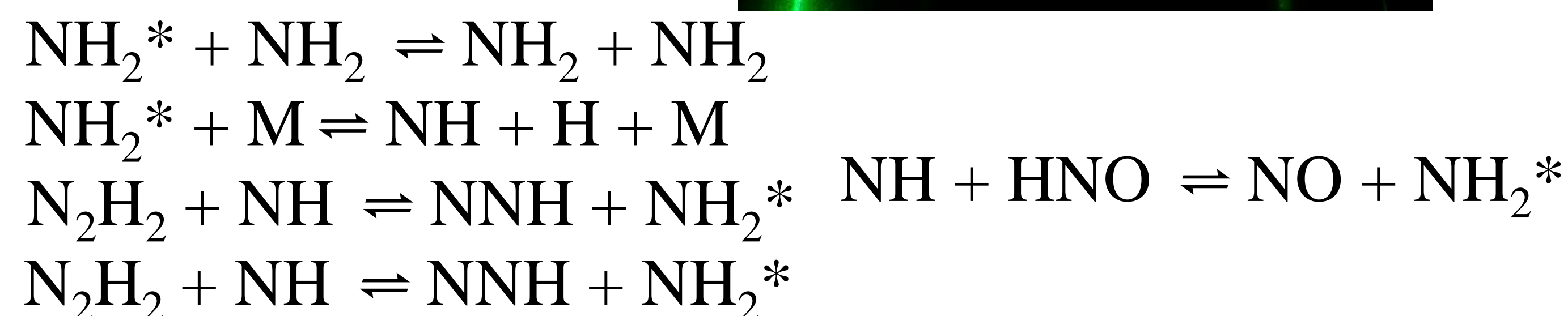
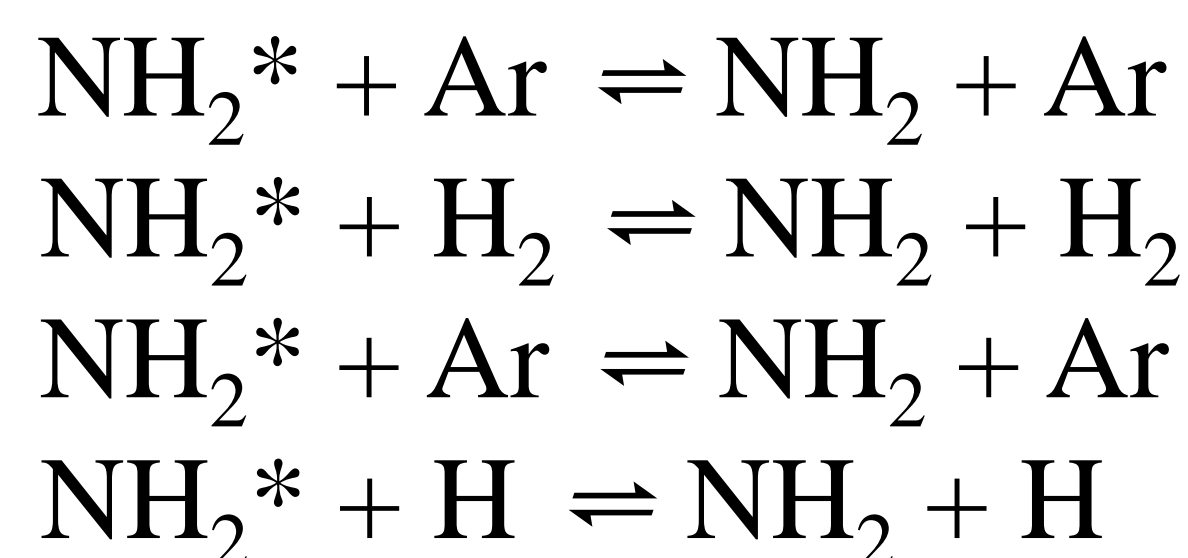
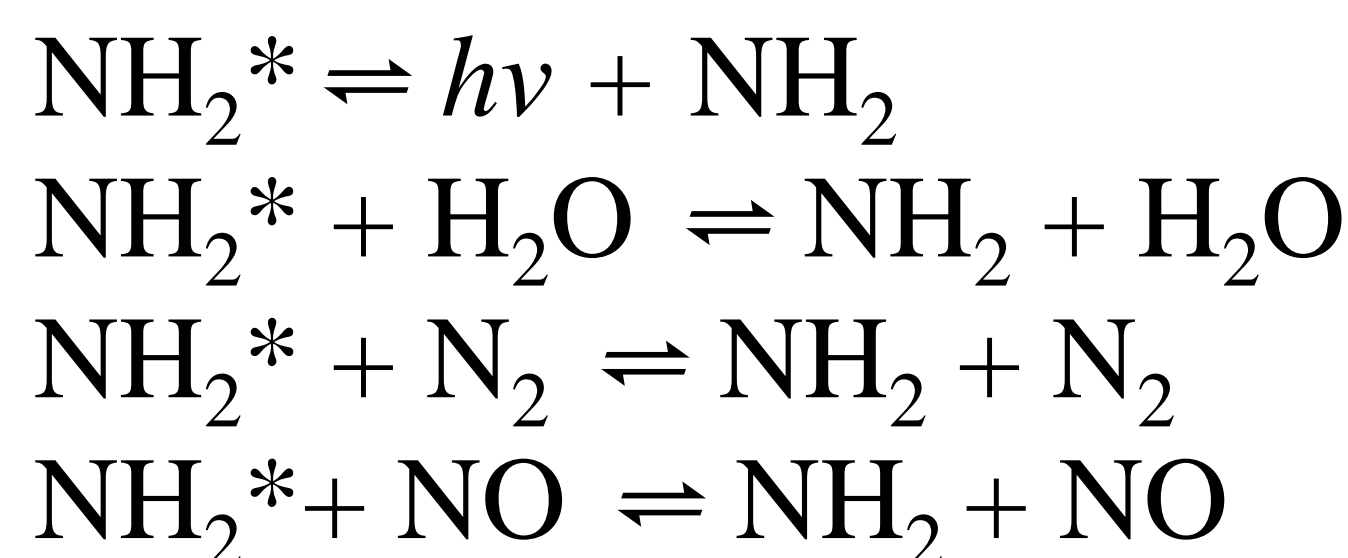
Chemiluminescence set-up  
 $\text{NH}_2^*$  - 632 nm  
 $\text{NH}^*$  - 337 nm  
 $\text{OH}^*$  - 310 nm



On superimposing  $\text{NH}^*$  and  $\text{NH}_2^*$  inverse Abel transformed image with the DEHS droplets evaporating at 525 K, the position of the species can be determined within the flame front



## $\text{NH}_2^*$ sub-mechanism: proposed reactions



## Experiment vs simulation

The proposed sub-mechanism can predict the width of the profiles quite well. The peak values depend on the base model. There is still room for improvement. Future work includes proposing sub-mechanism for other species.

## Acknowledgement

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