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Chemiluminescence in Premixed Ammonia-Air Flames

Alka KARAN^{I,II}, Guillaume DAYMA^{I,II}, Christian CHAUVEAU^{II}, Fabien HALTER^{I,II}

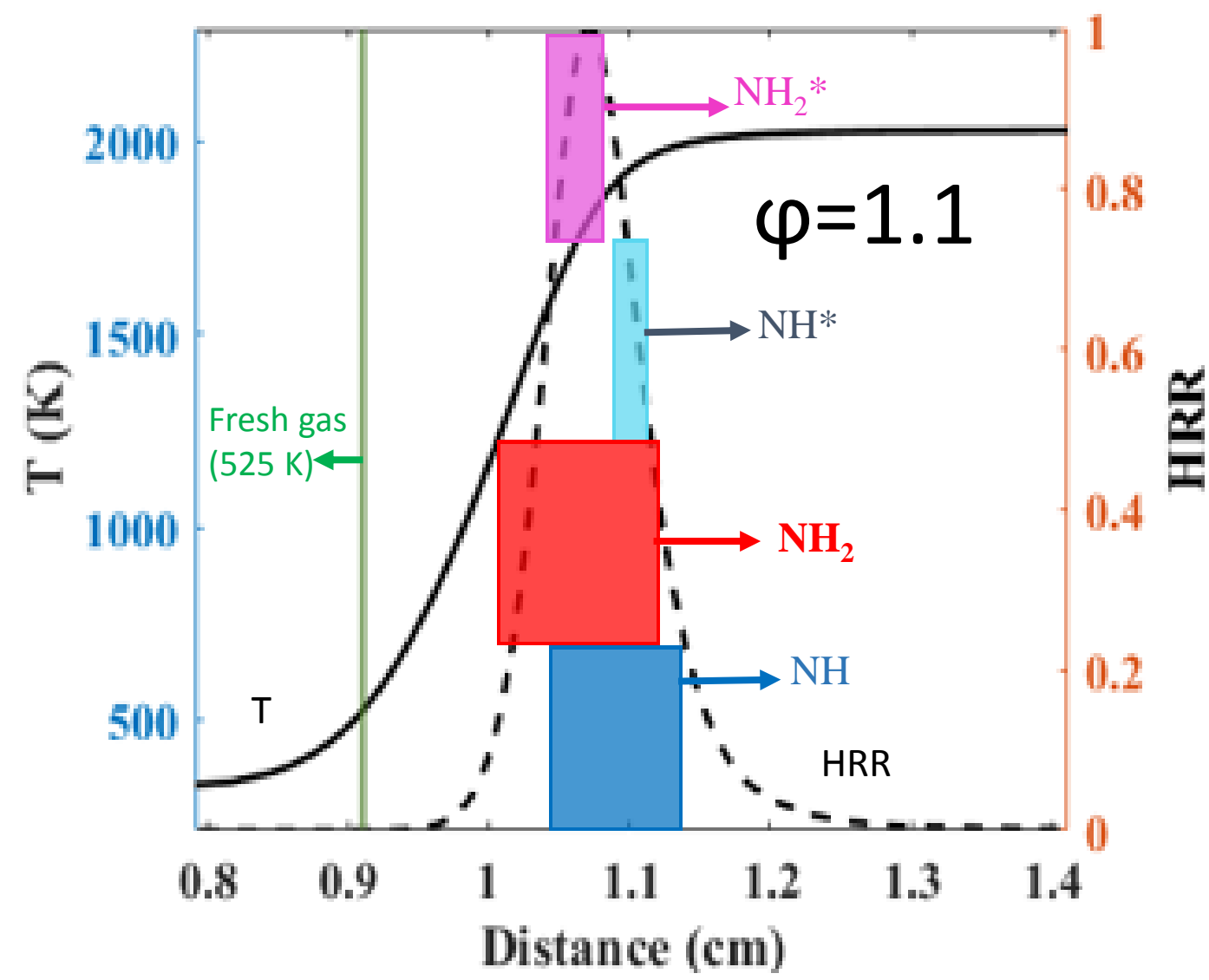
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Ammonia combustion is of great interest as it is a zero-carbon fuel and has a high octane rating. However, the flame properties have not been studied well. The objective of this work is to use an economic diagnostic tool to obtain useful data.

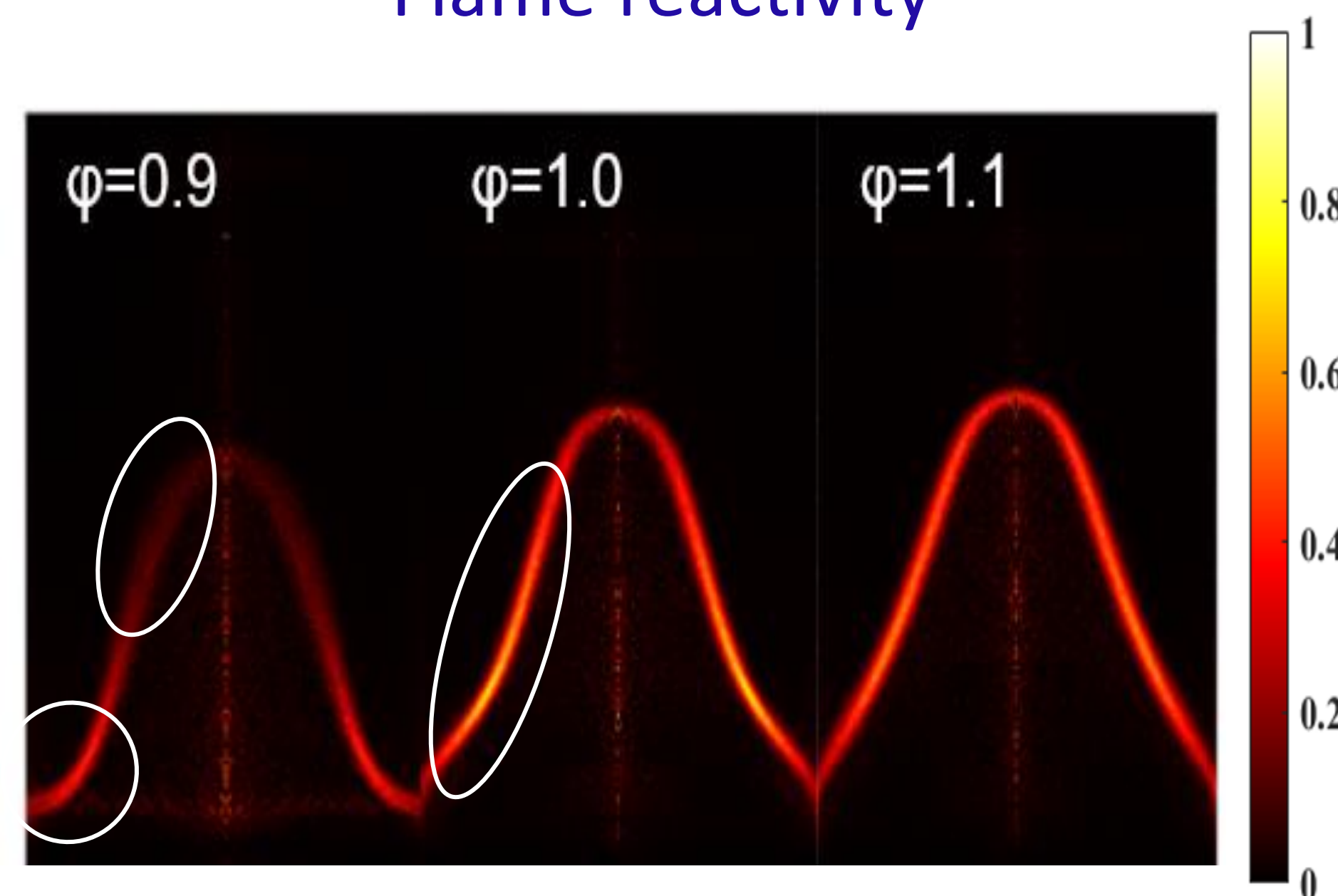
Chemiluminescence is a cheap and non-intrusive diagnostic tool that is widely used to obtain a large range of information pertaining to flame behaviour. In ammonia combustion, NH_2^* , NH^* , and OH^* have been identified as species of relevance.

Heat release rate marker



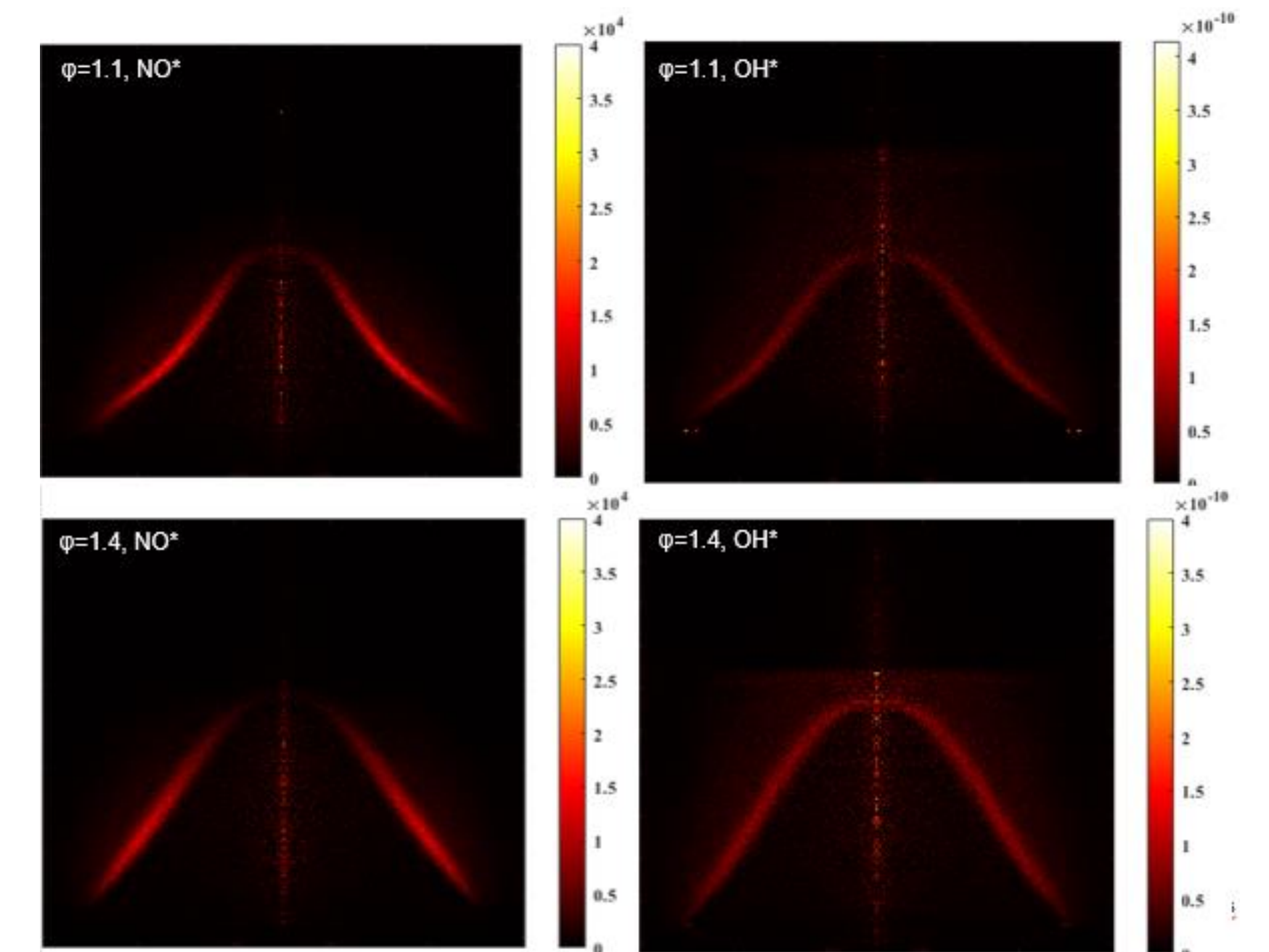
NH^* and NH_2^* have been identified as the HRR marker pure ammonia flames on a Bunsen burner configuration.

Flame reactivity

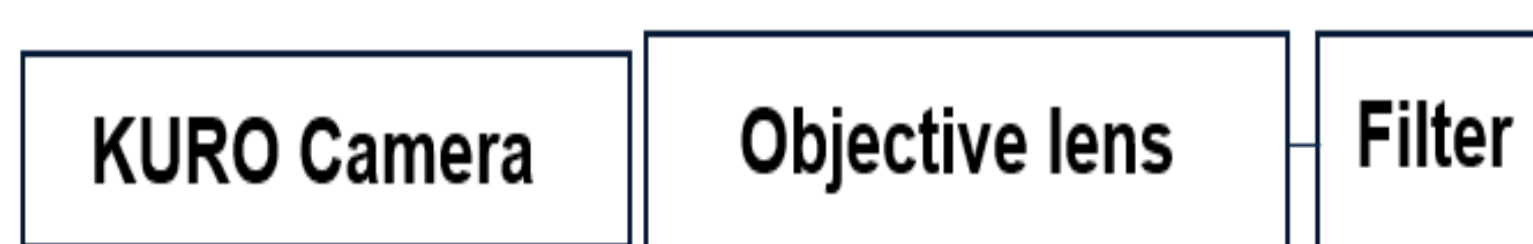


Change of intensity in NH_2^* profiles on a Bunsen burner configuration indicating local change of reactivity.

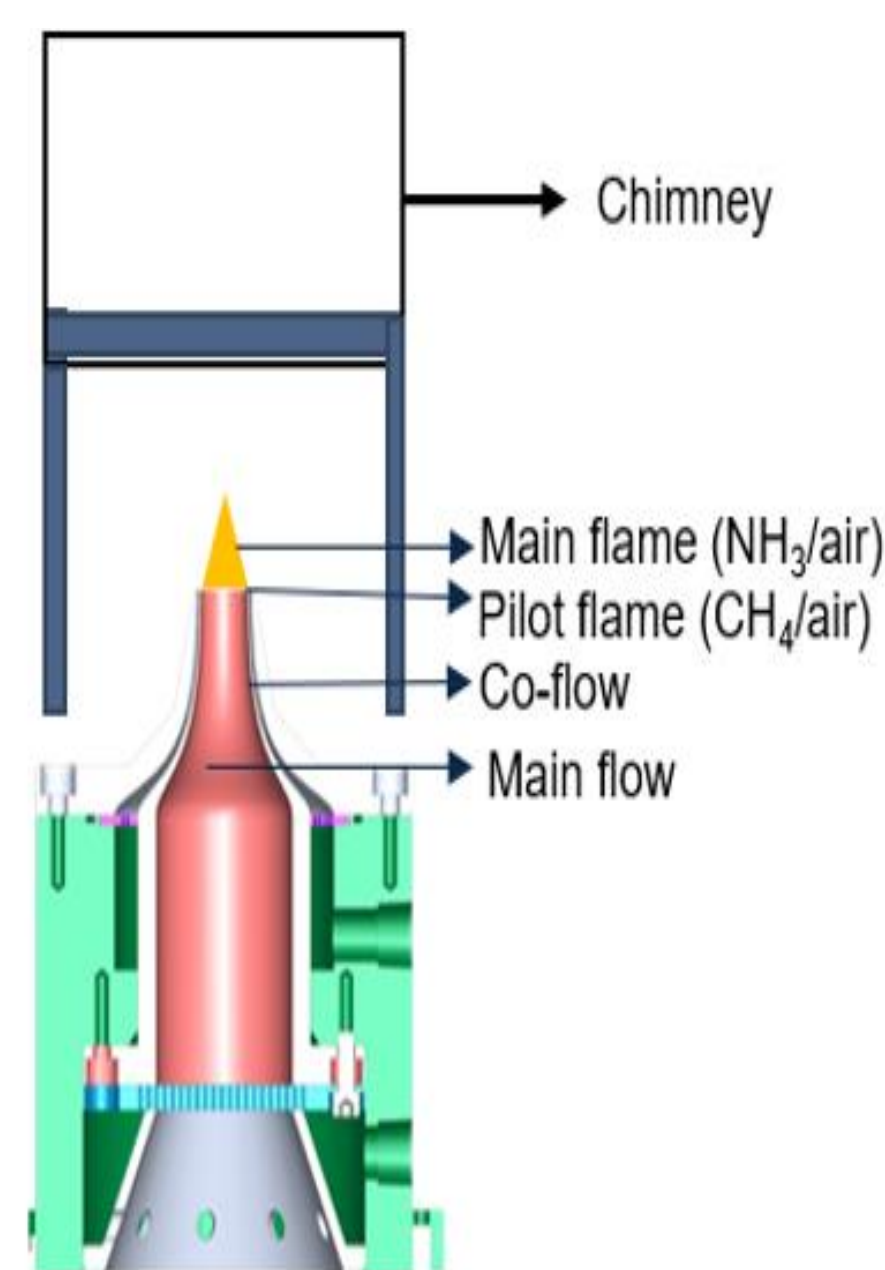
NO emissions



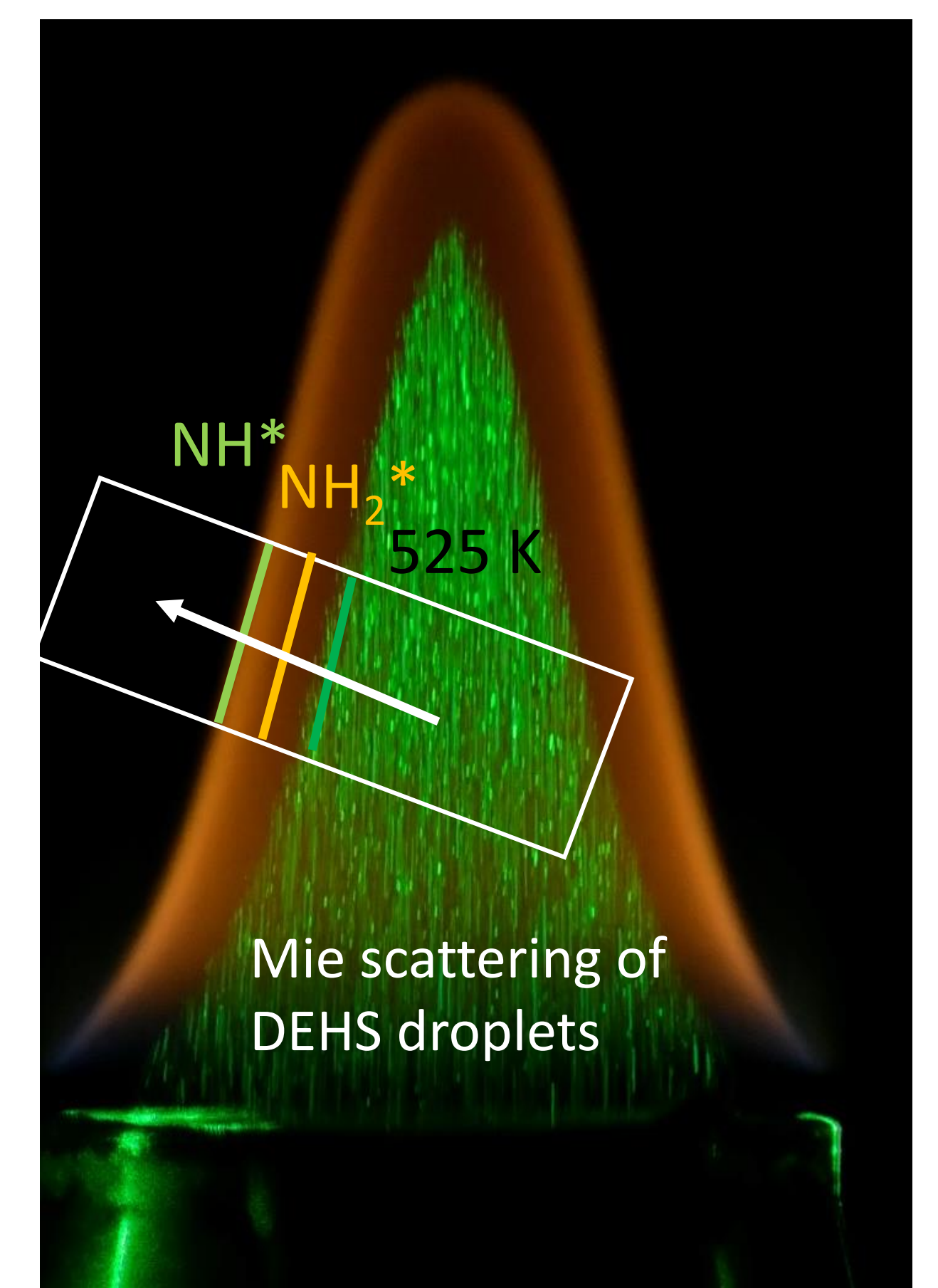
Relative NO^* emissions vs corresponding proportional OH^* emissions for two different equivalence ratios indicating OH^* predictions for relative NO quantities



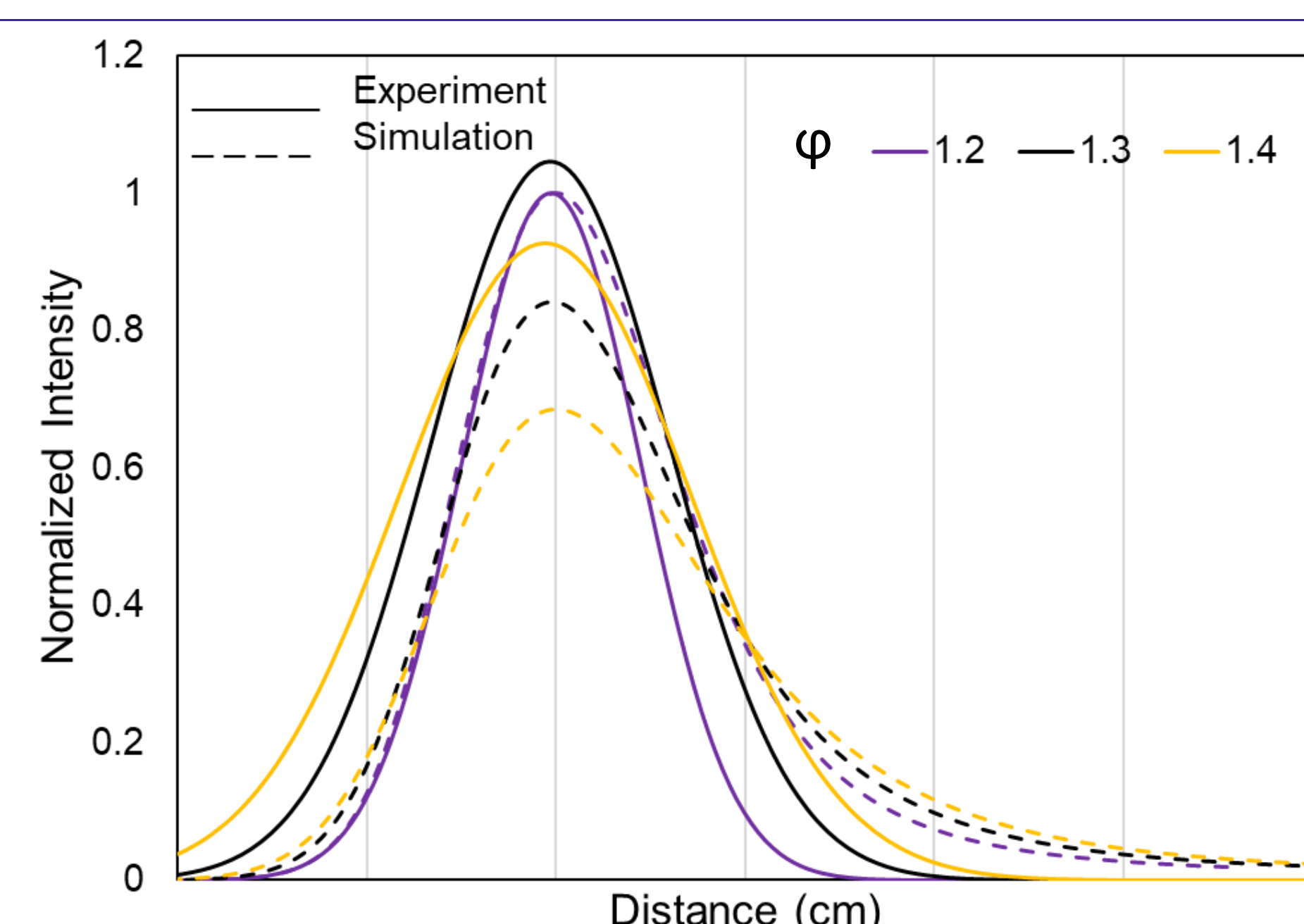
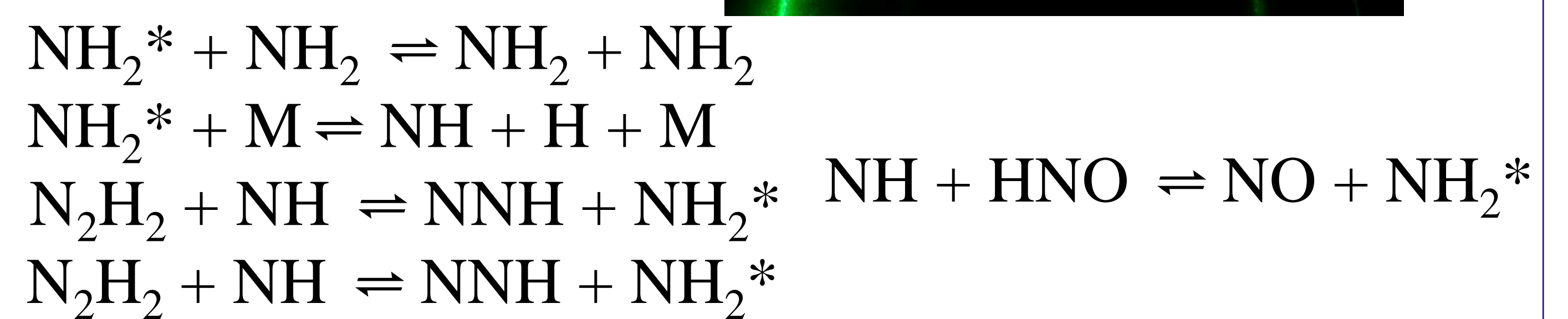
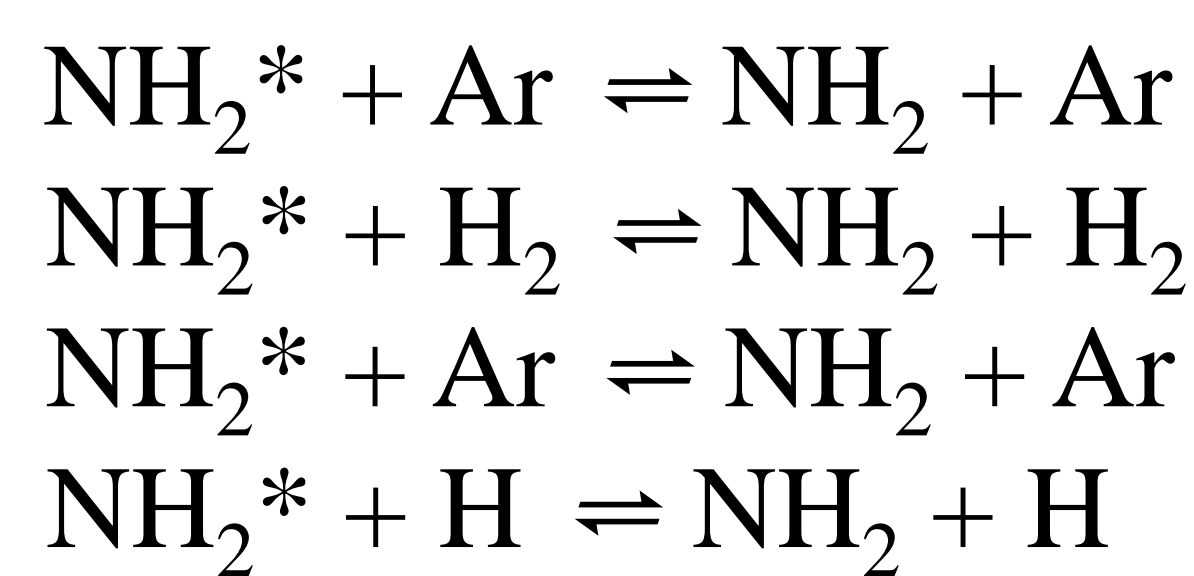
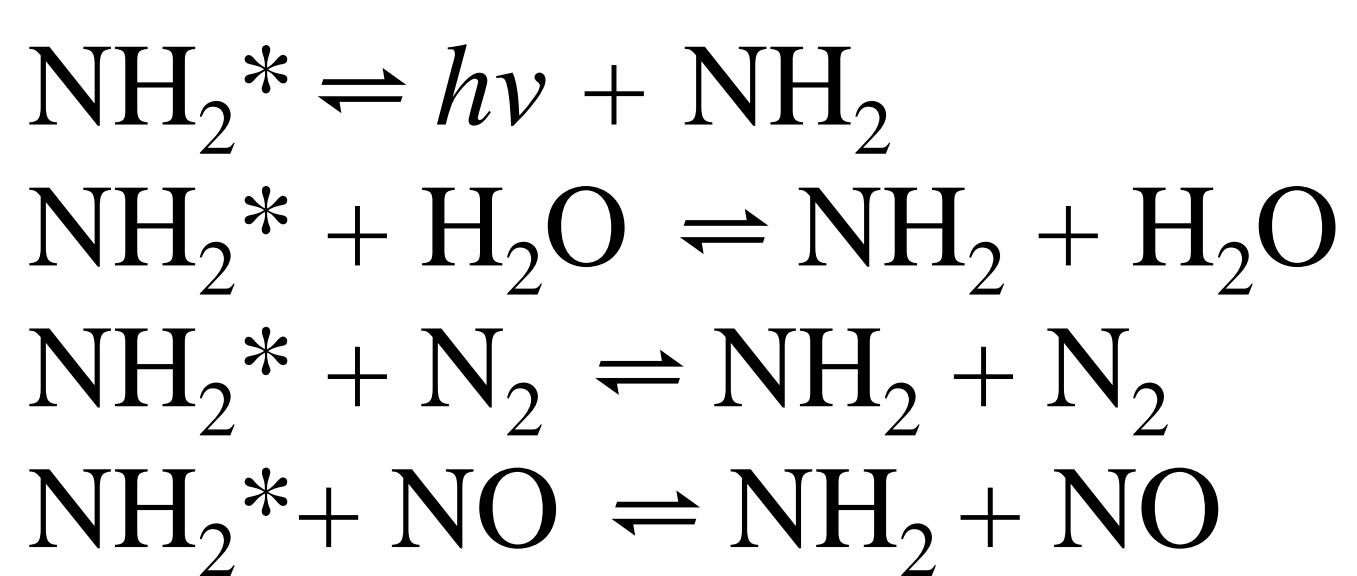
Chemiluminescence set-up
 NH_2^* - 632 nm
 NH^* - 337 nm
 OH^* - 310 nm



On superimposing NH^* and 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



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.

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