Surface production of H$^+$... 
... is based on a low work function $\Phi$ 
• Reduction of $\Phi$ by thin (several ML) cesium layers on source surfaces 
• Most relevant H$^+$ production process: Conversion of H on the plasma grid (PG) surface 
• Hot and dense plasma in the driver $\Rightarrow$ intense UV radiation impinging the PG 

Input of the performed calculations 
• Potential energy curves, adiabatic correction 
• Benchmarked model can be directly applied for plasma diagnostics

Results presented in [1]: 
• No effect of PE 
• Amount of photoelectrons (PE) produced by photoelectric effect at PG? 
• Influence of PE on the plasma sheath and source performance? 

Ro-vibrational Corona models for H$_2$ 
Excited states of H$_2$ $\rightarrow$ 
• Electronic, vibrational and rotational excitation $\Rightarrow$ huge number of levels 
• Necessary input data: 
  - Level energies 
  - Einstein coefficients 
  - Excitation cross sections 
  - Available ro-vibrationally resolved data base is scarce

Input of the performed calculations 
• Potential energy curves, adiabatic correction terms and dipole transition moments from [3] 
• Hiri-London factors from [4]

Output: Level energies and Einstein coefficients

Additionally used: Vibrationally resolved cross sections from [5] and [6]

Vibrational and rotational population of electronically excited states 
• Population of vibrational levels determined mainly by $T_{\text{rot}}(X^1)$ 
• Application of vibrationally resolved cross sections essential 
• Significant difference between Corona model and FCF scaling 
• No ro-vib resolved cross sections available. But: much smaller energy distances of rotational levels 
• Levels thermalize with the background gas 
• Introduce additional thermalizing collision reaction

Estimation of the influence of PE on the plasma in H$^+$ sources 
• Significant amount of photons originate from B$^1\Sigma^-\rightarrow X^1\Sigma^+$ and the atomic Lyman lines 
• Only ro-vibrationally resolved models for H$_2$ can precisely calculate the energy distribution of the relevant UV photons 
• New Corona models represent first steps towards a ro-vibrationally resolved CR model

Corona models for B$^1\Sigma^-\rightarrow X^1\Sigma^+$ and C$^3\Pi^-$ 
Good general agreement with the experiment, further benchmarking in preparation 
• PE produced at the PG do not influence the plasma sheath and the source performance

References 
[4]: A. Hansson et al, J. Mol. Spectrosc. 239 (2006), 182 

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...on the plasma sheath in hydrogen plasmas 
Emission of photoelectrons and their impact 

H$^+$ sources for ITER NBI

Simulation of hydrogen emission

Collisonal radiative models available and intensively benchmarked 

Hydrogen atom... 

Hydrogen molecule... 

Ro-vibrational simulation needed for precise determination of photon energy distribution 

Results presented in [1]: 

No effect of PE 

...for H$_2$ continuum $a^3\Sigma^--b^3\Pi$ only, neglecting B$^1\Sigma^--X^1\Sigma^+$ as well as $L_{\Sigma}$ radiation of H$^+$ 

• Using (by mistake) a too high quantum efficiency 

Variation of $T_{\text{gas}}$ and $T_{\text{eB}}$ 
Clearly visible influence on the structure of the spectrum 
• Comparison with experiment can be used for benchmarking the Corona models 
• Benchmarked model can be directly applied for plasma diagnostics

Comparison model $\Rightarrow$ experiment: Poster 1.32 (U. Fantz)