

THE FESHBACH RESONANCES APPLIED TO THE CALCULATION OF STARK BROADENING OF IONIZED SPECTRAL LINES: AN EXAMPLE OF INTERDISCIPLINARY RESEARCH

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Feshbach resonances take part in elastic collisional electron-ionized atom cross-sections. Z is the charge of the studied ion. These resonances are due to the fact that the colliding electron can be trapped on an excited state of the ion of charge $Z - 1$. This gives a temporary ion of charge $Z - 1$, and the trapped electron can be ejected by autoionization. These states form Rydberg series which converge towards the excited state of the ion of charge Z . Feshbach resonances were firstly applied to the calculation of elastic (and fine-structure cross-sections within a given term) electron-ion cross-sections in the sixties. In the beginning of seventies, the Feshbach resonances were applied to spectroscopic diagnostics in astrophysics, especially concerning the outer layers of the sun. The newly discovered X and XUV lines of ionized atoms were optically thin and formed out of LTE: many levels were coupled by electronic collisions and spontaneous emission. So, the "Statistical equilibrium equations" needed to be solved for obtaining their intensity. This idea permitted to understand and interpret the observations which remained in disagreement until then. It was also the case of the famous Fe XIV green line of the Corona. Then, as part of an interdisciplinary research, S. Sahal-Bréchet applied this idea to take into account the Feshbach resonances in the elastic contribution of electron collisions to Stark broadening of ionized lines in the impact approximation.

Within the framework of this interdisciplinary approach, and following Tsahal-Bréchet 2021, this work will be reviewed.

References

- [1] Sahal-Bréchet S., Dimitrijević M. S., Ben Nessib, N.: 2014, *Atoms* 2, 225
- [2] Fleurier, C.; Sahal-Bréchet, S.; Chappelle: 1977, *JQSRT* 1977, 595-603