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Invited Lecture

MODELING OF HYDROGEN BALMER LINES FOR THE DIAGNOSTIC OF MAGNETIC WHITE DWARF ATMOSPHERES

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Studies of white dwarf atmospheres have shown that the majority of white dwarfs have an atmosphere of pure hydrogen as a result of gravitational setting, which removes helium and heavier elements from the atmosphere and moves them towards inner layers [1,2]. These atmospheres can be considered as hydrogen plasmas, which are similar to some created in laboratory. Such white dwarfs are classified as of DA type due to the strong hydrogen absorption lines they present. The electron density in a white dwarf atmosphere is high enough (up to 10^{17} cm^{-3}, and higher) so that the line shapes are dominated by Stark broadening and, hence, can serve as a probe for the electron density. In this work, we address the broadening of the first lines in the Balmer series. A selection of problems related to the modeling of spectra is considered. At the atomic level, a proper description of a line shape requires the microfield evolution be accounted for during the time of interest of the transition under consideration (ion dynamics issue). On the other hand, the lines presenting a structure such as Hβ can exhibit an asymmetry due to presence of multipolar interactions, which is significant at high density regimes and must be retained in calculations [3]. Some observed white dwarf spectra also exhibit lines with a Zeeman triplet structure caused by the presence of strong magnetic fields [4,5]. We give a review of these problems and present new spectra calculations. Spectra observed in dedicated laboratory experiments [6,7] will also be discussed.

References

[1] Fontaine, G. and Michaud, G.: 1979, *Astrophys. J.*, **231**, 826.
[2] Rohrmann, R. D.: 2001, *Mon. Not. R. Astron. Soc.*, **323**, 699.
[3] Gomez, T. A. et al.: 2016, *Phys. Rev. A*, **94**, 022501.
[4] Küluebi, B. et al.: 2009, *Astron. Astrophys.*, **506**, 1341.
[5] Kepler, S. O. et al.: 2013, *Mon. Not. R. Astron. Soc.*, **429**, 2934.
[6] Falcon, R. E. et al.: 2015, *Astrophys. J.*, **806**, 214.
[7] Parigger, Ch. G. et al.: 2018, *Atoms*, **6**, 36.