Stark broadening of Zn II spectral lines in stellar atmospheres

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Broadening of spectral lines by interaction with electric microfield of charged particles, or Stark broadening is the most important pressure broadening mechanism for higher plasma temperatures and electron densities. Consequently, data for Stark broadening of different spectral lines are of importance for various plasmas in astrophysics, laboratory and inertial fusion investigations, for development and investigations of lasers and laser produced plasma research, modelling and diagnostics, as well as for plasmas in technology. Stark broadening data are especially needed and used in astrophysics, for abundance determinations, stellar spectra analysis and synthesis, stellar atmosphere modelling, opacity and radiative transfer calculations, determination of cosmic plasma parameters, and a number of other topics like stellar spectral type determination, modelling of subphotospheric layers, and monitoring of thermonuclear reactions in stellar interiors. Data on Stark broadenig of spectral lines are particularly needed for white dwarfs, because there, this is usually the principal pressure broadening mechanism. Atomic data for zinc, including Stark broadening, are often needed and for abundance determination of A and late B type stars. Zinc abundance determination for Galactic stars is important since the nucleosynthesis of this element is not well understood. Moreover, this is one of the key elements enabling to understand the star formation rate and chemical enrichment of the Galactic bulge. It is also important to probe the contribution of hypernovae at the lower metallicities during the bulge chemical enrichment process. Also, zinc can be observed in damped Lyman-α systems (DLAs), where, as the assumed proxy for Fe, it is of great importance for investigation of the chemical evolution of the Universe at high redshifts, by studying abundances in DLAs. The spectral lines of neutral and ionized zinc are observed in spectra of numerous stars of various spectral types. They are also of interest for modelling of subphotospheric layers and for radiative transfer calculations.

Stark broadening parameters of Zn II spectral lines have been measured several times. They are also calculated using the semiempirical and modified semiempirical methods and estimated using regularities and systematic trends. We have calculated Stark broadening parameters, full widths at half intensity maximum and shifts for 34 multiplets of singly charged zinc ion, using the impact semiclassical perturbation formalism. Stark broadening parameters due to collisions with electrons, protons and helium ions have been obtained for a grid of electron densities and temperatures. The obtained results have been used to demonstrate the influence of Stark broadening mechanism on spectral lines of Zn II in stellar atmospheres. Stark widths and shifts for Zn II spectral lines will be also implemented in the STARK-B database (http://stark-b.obspm.fr/), which is a part of Virtual Atomic and Molecular Data Center (VAMDC - https://portal.vamdc.eu/vamdc_portal/home.seam). We note as well, that a link to STARK-B is in the Serbian Virtual Observatory (SerVO, http:servo.aob.rs).