D-line doublet observations of Na-like ions

S.C. Sanders[1], A. C. Gall[1,2], R. Silwal[1,2], J. D. Gillaspy [2,3], A. S. Naing[2], J. Tan[2], Yu. Ralchenko[2], and E. Takacs[1,2]

[1]Department of Physics and Astronomy, Clemson University, Clemson, SC 296342
[2]National Institute of Standards and Technology, Gaithersburg, MD 20899
[3]National Science Foundation, Alexandria, VA 22314, USA, USA

We present simultaneous measurements of the *D*1 ($3s\text{-}3p_{1/2}$) and the *D*2 ($3s\text{-}3p_{3/2}$) transitions in Na-like ions of yttrium [1], zirconium, niobium, molybdenum, praseodymium, neodymium, rhenium, osmium, and iridium. The highly charged species were created using the NIST electron beam ion trap (EBIT) [2] and the spectra were recorded with a flat-field grazing-incidence extreme ultraviolet (EUV) spectrometer [1]. The collisional-radiative (CR) modelling code NOMAD [3] aided the line identification measurements of these $\Delta n = 0$ transitions. The CR model uses a realistic non-Maxwellian electron energy distribution applicable to the EBIT and input atomic data from the FAC [4]. We show comparisons of the experimental wavelengths to those determined from relativistic many-body perturbation theory (RMBPT) [5] and *S*-matrix QED calculations [6]. Our experimental wavelengths agree with both theories overall, with deviations occurring at higher Z values. These comparisons test the accuracy of the calculation of QED corrections for the sodium isoelectronic sequence at high Z values, where experimental observations are lacking. In addition to the Na-like *D*-doublet observations, we also report measured wavelengths for transitions arising from the Si-, Al-, and Mg-like charge states of these ions.

References

[1] R. Silwal, E. Takacs, J.M. Dreiling, J.D. Gillaspy, and Yu. Ralchenko, Atoms (2017), *5*, 30.
[2] J. D. Gillaspy, Phys. Scr. T71 (1997) 99-103.
[3] Yu. Ralchenko and Y. Maron, J. Quant. Spectr. Rad. Transf. 71 (2001) 609-621.
[4] M. F. Gu, Can. J. Phys. 86 (2008) 675-689.
[5] J.D. Gillaspy, D. Osin, Yu. Ralchenko, J. Reader, and S.A. Blundell, Phys. Rev. A. 87 (2013)
[6] J. Sapirstein and K.T. Cheng, Phys. Rev. A. 91 (2015)