PHOTOABSORPTION TO EVEN-PARITY AUTOIONIZING LEVELS OF Na I FROM THE LASER-POPULATED $3p\,^2P$ STATES

J. Sugar, T.J. McIlrath, T.B. Lucatorto and A.W. Weiss
Optical Physics Division, National Bureau of Standards
Washington, D.C. 20234

A column of sodium vapor with a significant fraction of the atoms in the $3p\ ^2P$ state (excited state density of the order of 10^{15} atoms/cm^3) was prepared by axially irradiating a sodium heat-pipe oven with a pulsed dye laser tuned to the 3s-3p resonant frequency. This technique has recently been shown to produce nearly complete ionization of the illuminated column in $\sim$ 600 nsec.[1] By passing continuum VUV light down the pipe 150 nsec after initiating the laser pulse, an absorption spectrum of neutral excited state sodium is obtained in the region of autoionizing levels containing the $2p^5 3s3p$ and $2p^5 3d3p$ configurations. The continuum is produced by a BRV-type triggered spark that gives a light pulse of $\sim$ 100 nsec duration in the wavelength range of observation of $\sim$ 200-400 A. About 25 absorption lines are attributed to these configurations based on predicted wavelengths obtained from an intermediate coupling calculation of the autoionizing levels, including configuration interaction. This appears to be the first observation of these even parity levels, which are inaccessible to photabsorption from the ground state by electric dipole transitions.

1. T.B. Lucatorto and T.J. McIlrath, Phys. Rev. Lett. 38, 428 (1976).

https://doi.org/10.1017/S0252921100120378 Published online by Cambridge University Press