MILLIMETER WAVE SPECTROSCOPY AND MQDT CALCULATIONS OF HIGH RYDBERG STATES OF KRYPTON

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A phase-stabilised backward wave oscillator (BWO) in the 260–380 GHz range was combined with a VUV laser system to record high-resolution spectra of high-n Rydberg states of krypton. Krypton atoms were excited into np (n=58,60) Rydberg states via the 4d[1/2] ($J = 1$) state using VUV and visible laser photons. Millimeter wave transitions between np and ns or nd Rydberg states were detected by pulsed field-ionization, at sub-MHz resolution and with mass selection. Using this excitation scheme, very accurate relative energies of fine and hyperfine structure levels of $(n + 2)$s and nd (n=68–74) Rydberg states of ^{84}Kr and ^{83}Kr were obtained. In this region, s-d interactions are observable for ^{83}Kr due to the hyperfine interaction.
A multichannel quantum defect theory (MQDT) treatment of the hyperfine structure[a] was used to analyze the millimeter wave data in combination with recent high-resolution VUV laser data[a] and the available data from the literature; improved MQDT parameters and hyperfine structure data of the ^{2}P ground electronic state of ^{83}Kr$^+$ were obtained.

[a] H. J. WÖRNER, U. HOLLENSTEIN, AND F. MERKT, *Phys. Rev. A*, **68**, 032510 (2003).