

High-resolution spectroscopy and multichannel quantum-defect-theory analysis of high Rydberg states of xenon.

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High-resolution spectra of high np and nf Rydberg states of Xe were measured by single - photon excitation from the metastable state of Xe $(5p)^5(6s)^1\ ^3P_2$ to the energy region located below the $Xe^+ (5p)^5\ ^2P_{3/2}$ ionization threshold. The experiments were carried out using a pulsed Fourier-transform-limited narrow-band UV laser and a supersonic-beam apparatus.

The fine and hyperfine structures of np and nf Rydberg states of the nine most abundant isotopes of xenon have been analyzed in the range of the principal quantum number between 60 and 75 using multichannel quantum-defect-theory (MQDT). For the analysis of the fine structure of xenon, the formalism introduced by Lu and Lee [1] and Lu [2] was followed. This formalism was extended by Wörner et al. [3,4] and Schäfer et al. [5] to treat the hyperfine structure in Rydberg states of ^{129}Xe and ^{131}Xe . By using the eigenquantum defects and channel interaction parameters for the even-parity states of xenon from Schäfer et al. [5], improved values of the ionization energies and the isotopic shifts have been determined from the MQDT analysis.

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