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

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High-resolution spectra of high *n*p and *n*f 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 *n*p and *n*f 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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