Spectroscopy of Few-body Hadronic Atoms: Energy Shifts, Widths and Strong K,pi-N Interaction Correction

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Paper is devoted to studying spectra, hyperfine, energy shifts and widths for a number of the few-body hadronic (kaonic and pionic) atoms. Ap present time the transition energies in pionic and kaonic atoms have been measured with an unprecedented precision [1,2]. The spectroscopy of hadronic hydrogen allows to study the strong interaction at low energies by measuring the energy and width of the ground level with a precision of few meV. The light hadronic atoms can additionally be used to define new low-energy X-ray standards and to evaluate the pion mass using high accuracy X-ray spectroscopy. Ab initio QED approach [3] with an accurate account of relativistic, nuclear, radiative effects is used in calculating spectra of the hadronic (pion, kaon) atoms. One of the main purposes is establishment a quantitative link between quality of nucleus structure modelling and accuracy of calculating spectral properties. The wave functions zeroth basis is found from the Klein- Gordon-Fock equation. The potential includes SCF ab initio potential, the electric and polarization potentials of a nucleus (the RMF and Gauss models for a nuclear charge distribution are used). The energy shift is connected with a length of the hadron-nuclear scattering. The Lamb shift polarization part is treated in the Uhling-Serber approximation and the self-energy part - within the Green function method [3]. We present the data on the hyperfine structure parameters, energy shifts and widths of transitions (2p-1s,3d-2p, 4f-3d etc) in pionic and kaonic atoms (H, He, Li, W, U).

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