Energy spectrum of charge carriers is researched with and without magnetic field in Kane-type semiconductor quantum nanostructures in case of finite potential barrier $V$. The model that is considered in the present study is composed of two concentric quantum wires. The inner part and outer part are made up of GaAs and $\text{Al}_x\text{Ga}_{1-x}\text{As}$, respectively.

In the first part, it is shown that energy spectrum of carriers depends on quantum wire radius for finite potential barrier without magnetic field by using Kane model. In the second part, energy spectra of charge carriers are calculated as the function of magnetic field by using Kane model in $\text{Al}_x\text{Ga}_{1-x}\text{As}$/GaAs quantum wire and compared with results of parabolic approach. It is also shown that g-factors of electrons rely on radius. It is seen that g-factor of electrons is increasing while radius is decreasing. The applied model is also useful for obtaining the energy spectra of light holes and spin–orbit splitting holes.