

This thesis contains a study of production and radiation of  $J/\psi$  and  $\psi(2S)$  in  $pp$  collisions. Basic analysis of  $J/\psi$  and  $\psi(2S)$  using data from  $pp$  collisions at  $\sqrt{s} = 5.02\text{TeV}$  measured in 2017 by the ATLAS Experiment at the LHC is performed. The yield of  $J/\psi$  is separated into prompt and non-prompt components. A comparison between Monte Carlo generator PYTHIA 8.240 and data collected by the ATLAS Experiment in 2015 and 2017 at  $\sqrt{s} = 5.02\text{ TeV}$  is done. Transverse momentum dependent discrepancy between data and simulation is observed. It is seen that the description of charmonia production by PYTHIA 8 is limited since it cannot reproduce the shape of measured cross-section. An introduction to yield extraction using RooFit from measured data is also provided.

Another part of this thesis is the description of charmonium production and gluon radiation in  $pp$  collisions simulated by PYTHIA generator. The slow growth of the mean value of the number of gluons radiated by charmonium intermediate octet state with increasing  $p_T$  is observed.