The bubble regime of LWFA driven by the super-Gaussian pulse  
  
The non-linear bubble regime of laser-wakefield acceleration (LWFA) is studied for a laser beam with a spatial super-Gaussian profile of a higher order. Contrarily to the Gaussian pulse, the intensity profile of the super-Gaussian pulse and e.g., in particular, for super-Gaussian beam is flat over almost all the covered area, which alters the bubble shape in a different way. Moreover, diffraction rings are induced during the formation of the super-Gaussian pulse. These properties affect the values of wakefield and the whole acceleration process directly. In order to address this issue, the process is investigated for standard parameters feasible with current sub-100 TW laser systems by means of numerical particle-in-cell simulations. It is shown that an additional electron injection can occur due to the evolution of the laser pulse. As a consequence, parameters of the electron bunch vary from the ones generated by a Gaussian pulse.