Chapter 6 Conclusion and Future Works

In the thesis, we have successfully generated supercontinuum white light bottle beam by passing SC beam from the MFs through assembly of an axicon and a positive lens. Different central wavelength of bottle beam can be obtained by passing through a line color filter. Due to the dispersion of axicon and focus lens, the positions of two foci and diameter of bottle beam would depend on the central wavelength. Thus, the range of the white light bottle beam is as predicted the smallest. In use of the Fresnel-Kirchhoff's diffraction formula and considering Gaussian input beam profile, the ranges of optical bottles at different central wavelengths were estimated, which is consistent with the measured results. We recognized that this white light source can enhance trapping ability for the microscopic particles with slightly different sizes and different atoms required for different blue-detuning wavelength. For application on atom trapping of micro-sized region, the objective lens of the shorter focal length to focus beam and the smaller conical angle of axicon would be obtained from our simulation based on vectorial field. The longitudinal field must be considered at this condition. From our simulated results, we understand the smaller focal length of lens, the higher contribution the longitudinal field provided. If the linear polarization input light filed is used, the beam pattern at position Z_b, where the thinnest ring was found, appears with two high intensity distributions along the input polarization axis. Due to this interesting result, we discovered that one can rotate the cigar-shaped microparticles trapped by the bottle beam along the linear polarization axis through properly rotating the input linear polarization direction.

In our future works, we could try to trap the particles by using supercontinuum white light bottle beam to observe the trapping phenomenon. Next, we could make sure that the linear polarization input field passed through this assembly to generate specific pattern bottle beam. And try to optimize the vectorial diffraction integrals to more accurate as

the results of Fresnel-Kirchhoff's diffraction in the condition of $\gamma = 5^0$ and $f = 35.08$ mm by considering more conditions.