The optical activity mimic comprises an SVR sandwiched between two orthogonally oriented quarter-wave plates.

Laser beams profile observed in the far field. High radial polarization purity ~99.98% at far field distribution.

The generation of a tighter focus laser beam is one of the most important research topics for optical scientists and engineers. A tighter focus means better resolution for laser lithography and microscopy, higher cutting speed and cutting resolution for laser machining applications and a high storage density for optical data storage application.
By creative and non-obvious uses of polarization physics, the team led by Dr Phua Poh Boon, have invented four new methods to generate such "holey" laser beam by using spirally varying retarder [1, 2], birefringent walk-off crystals [3], EO-radial polarization retarder [4], and BK7 cylinder for Goos-Hanchen phase shift [5].

These methods offer advantages such as cheaper fabrication, a more accurate radial polarization profile and possibility to fabricate large-aperture optics, a high-speed switchability and potentially allowing mass production which is particularly important in commercial applications such as optical data storage.

One particular invention is showed promising results for high power laser application is the method which mimics a spirally varying optical activity using linear birefringent material [1], sandwiched between two appropriately oriented quarter-wave plates. This method produces the exact radial polarization profile.

Together with the help of our collaborator, Data Storage Institute (ASTAR), the first Spirally Varying Retarder was fabricated within a year and demonstrated that the idea works. The fabricated Spirally Varying Retarder was then tested and characterized by the team from TL@NTU. Within three years of intensive results, today, DSO can produce this specialised optics with a large aperture size which can handle many kilowatts of laser power. Compared to other methods reported in open literature, our method provides one of the best approaches in terms of polarization purity and high power handling.

References:


