CLAIMS

What is claimed is:

1. A holographic data storage device with a single-arm structure, wherein a reference beam in form of a spherical light wave is interfered with a signal beam on a storage medium to form a hologram, and storage capacity is increased by a shift multiplexing method; the holographic data storage device comprises a beam combiner and a beam splitter, which perform beam combining and splitting operations on the reference beam and the signal beam with orthogonal polarization directions successively; and a relay lens group and a filter are disposed between the beam combiner and the beam splitter to transmit and filter the reference beam and the signal beam.

2. The holographic data storage device with a single-arm structure according to claim 1, wherein the beam combiner and the beam splitter are optical elements with polarization selectivity characteristics.

3. The holographic data storage device with a single-arm structure according to claim 1, wherein the filter is a low-pass filter, configured to control the size of the hologram on the storage medium.

4. The holographic data storage device with a single-arm structure according to claim 1, wherein at least one of lens elements in the relay lens group is installed on a translation stage in a beam axis direction.

5. The holographic data storage device with a single-arm structure according to claim 1, wherein at least one of lens elements in the relay lens group is installed on a translation stage in a shift multiplexing direction.

6. A holographic data storage device with a single-arm structure, comprising: a

laser output unit, a beam combining unit, a reference arm, and a beam splitting unit, wherein the laser output unit is configured to output light and perform beam expansion processing on the light; the light subjected to beam expansion processing is incident to the beam combining unit, and the beam combining unit converts the input light into a signal beam and a reference beam which are combined into a common beam and have orthogonal polarization directions, and outputs same to the beam splitting unit; the beam splitting unit separates the received signal beam and reference beam, the reference beam enters the reference arm, and the signal beam is incident to a storage medium; the reference beam is adjusted by the reference arm and then incident to the storage medium; the signal beam and the reference beam are emitted and interfered on the storage medium to form a hologram for recording information in the storage medium, and storage capacity can be increased by a shift multiplexing method.

7. The holographic data storage device with a single-arm structure according to claim 6, further comprising a signal reproduction unit, configured to read a signal stored in the storage medium.

8. The holographic data storage device with a single-arm structure according to claim 6, wherein the laser output unit comprises a light source emitter, a beam expander, and a half-wave plate; and light emitted from the light source emitter is processed by the beam expander and the half-wave plate and then incident to the beam combining unit.

9. The holographic data storage device with a single-arm structure according to claim 6, wherein the beam combining unit comprises a beam combiner, a spatial light modulator, a reflector, and a relay lens group; the beam combiner first divides light from the laser output unit into a reference beam and a signal beam with orthogonal

polarization directions; the signal beam is reflected by the reflector and then loaded with an input modulation signal by the spatial light modulator; the modulated signal beam and reference beam converge in the beam combiner, pass through the relay lens group together, and then are incident to the beam splitting unit.

10. The holographic data storage device with a single-arm structure according to claim 6, wherein the beam combining unit comprises a beam combiner, a spatial light modulator, a reflector, a first quarter-wave plate, a second quarter-wave plate, and a relay lens group; the beam combiner first divides light from the laser output unit into a reference beam and a signal beam with orthogonal polarization directions; after the signal beam is reflected by the reflector and transmitted twice by the first quarter-wave plate, the polarization direction becomes vertical polarization, and the signal beam is reflected by the beam combiner, passes through the second quarter-wave plate and then is loaded with an input signal by the spatial light modulator and reflected; the modulated signal beam is incident to the beam combiner again after passing through the second quarter-wave plate again, and combines with the reflected reference beam to pass through the relay lens group together and then is incident to the beam splitting unit.

11. The holographic data storage device with a single-arm structure according to claim 9 or 10, wherein a low-pass filter is disposed in the middle of the relay lens group to spatially filter the signal beam.

12. The holographic data storage device with a single-arm structure according to claim 9 or 10, wherein the beam combiner is an optical element with polarization selectivity characteristics, which is a polarizing beam splitter.

13. The holographic data storage device with a single-arm structure according to claim 6, wherein the beam splitting unit comprises a beam splitter and a Fourier lens;

the signal beam and the reference beam from the beam combining unit are separated by the beam splitter; the signal beam is incident to the Fourier lens and then to the storage medium; and the reference beam is incident on the reference arm.

14. The holographic data storage device with a single-arm structure according to claim 13, wherein the beam splitter is an optical element with polarization selectivity characteristics, which is a polarizing beam splitter.

15. The holographic data storage device with a single-arm structure according to claim 6, wherein the reference arm comprises a reflector and a half-wave plate; the polarization direction is adjusted by the half-wave plate after the incident reference beam passes through the reflector, so that the polarization direction of the reference beam is the same as the signal beam, and then the reference beam is incident to the storage medium.

16. The holographic data storage device with a single-arm structure according to claim 7, wherein the signal reproduction unit comprises a Fourier lens and a photodetector; the reference beam is irradiated on the hologram for recording information in the storage medium, and input information is reproduced by the obtained diffracted light in the original signal beam direction, and is read by the photodetector after being processed by the Fourier lens.