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Holographic Optical Tweezing (HOT)

Overview: Holographic optical tweezing uses tightly focused laser beams to manipulate the 3D position of objects within a field of view. This can be used for research in fundamental physics, biological studies, and cold atom trapping. The SLM is used to modulate the phase of an incident laser beam to create a 3D volume of focal points. Objects with a higher refractive index than the surrounding media are pulled toward the waist of the focal points, allowing the ability to manipulate the position of objects with diameters ranging from 10 nm to 100 µm with micron scale control.

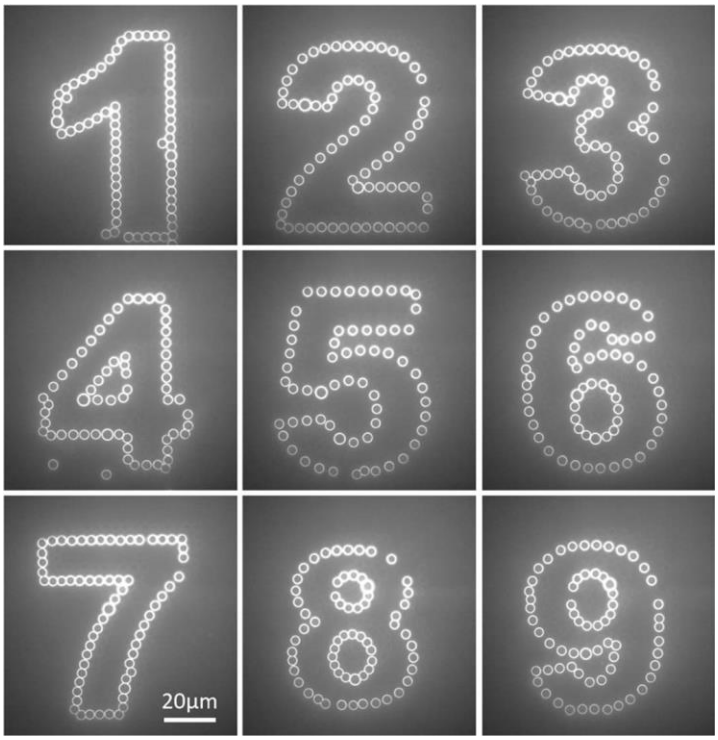

Figure 1 Shaw, L. A., Chizari, S., & Hopkins, J. B. (2018). Improving the throughput of automated holographic optical tweezers. Applied optics, 57(22), 6396-6402.

Critical requirements: For this market the SLM must provide high resolution, high phase stability, and high speed. The resolution of the SLM determines the field of view that objects can be manipulated in and the number of traps that can be created which determines the throughput of experimental studies. The phase stability of the SLM allows the incident power to be minimized while maintaining a stable trap. Use of a high speed SLM has been demonstrated as a means to dynamically dampen Brownian motion to maximize trap strength and minimize required incident power to maintain a stable optical trap. For work with biological samples, limiting the incident power and duration of exposer are critical to maintaining viability.

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