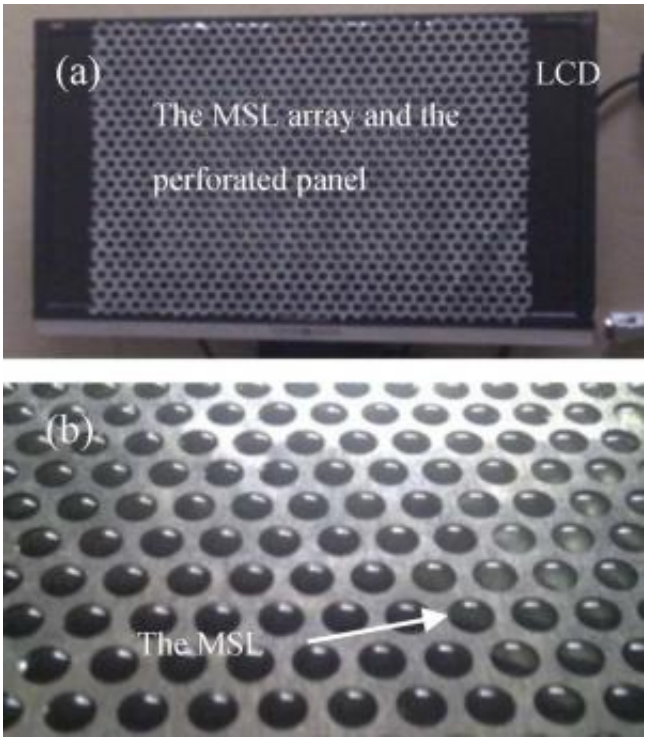
Glasses-free 3D display is made with tiny spherical lenses

March 9 2015, by Lisa Zyga



(a) Prototype of the proposed 3D display. (b) The microsphere lenses can project images to different spatial directions. Their larger curvature compared to planar lenses increases the viewing angle. Credit: Lv, et al. ©2015 IEEE

One of the most common methods of creating the illusion of 3D is the autostereoscopic display, which is based on parallax: each eye is presented with a slightly different angle of a scene. Often this is done with many tiny microlenses, each projecting a small amount of light.

Although this method has many advantages and is already being used in commercial products, such as the Nintendo 3DS, its narrow viewing angle is still a problem for expanding its use to larger displays.

In a new paper published in IEEE's *Journal of Display Technology*, researchers at Chengdu Technological University and Sichuan University, both in Chengdu, China, have addressed the narrow viewing angle problem by replacing the flat microlenses with microsphere lenses. They have built a prototype that demonstrates that the larger curvature of the spherical lenses increases the viewing angle from 20-30° to 32°, with a theoretical viewing angle of up to 90°.

Although there is still room for improvement, the researchers hope that this strategy could lead to wider viewing angles and eventually to multiview 3D displays. Because microsphere-lens arrays can be easily manufactured by ball placement technology, the researchers estimate that the displays could be made at low cost, making it promising for applications.

"The greatest significance is that we propose a cheap and simple way to fabricate a lens array which can bring a wider viewing angle," lead author Guo-Jiao Lv at Chengdu Technological University told *Phys.org*.

Another advantage of using the microsphere lenses for 3D displays is low crosstalk, the problem that occurs when light from the right and left channels leak into each other, interfering with the overall image. In the new prototype, the researchers show that the light from each lens can be concentrated in a small area so that crosstalk is limited. However, there is a tradeoff here, since lowering crosstalk by making smaller light spots has the negative effect of decreasing the brightness and overall optical efficiency. The researchers plan to address these challenges in the future.

"We are planning to improve the performance of 3D display devices

further, including improving the resolution ratio, crosstalk, and optical efficiency," Lv said. "We are also trying to make 3D display devices thinner because the optical component makes 3D displays much thicker than the conventional 2D displays now."

More information: Guo-Jiao Lv, et al. "Glasses-Free Three-Dimensional Display Based on Microsphere-Lens Array." *Journal of Display Technology*. DOI: 10.1109/JDT.2014.2385098