# Putting Spatial Light Modulators to Work

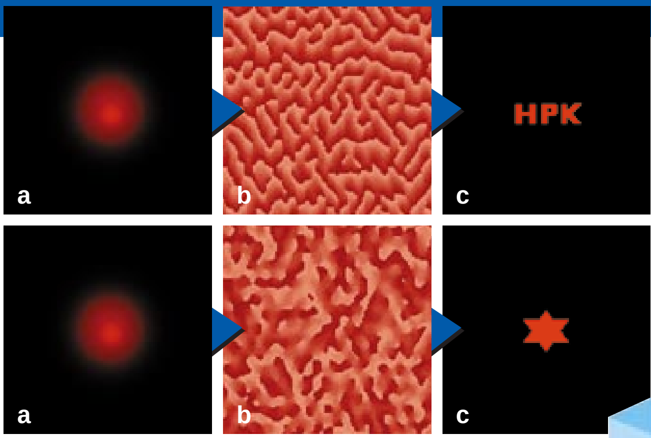
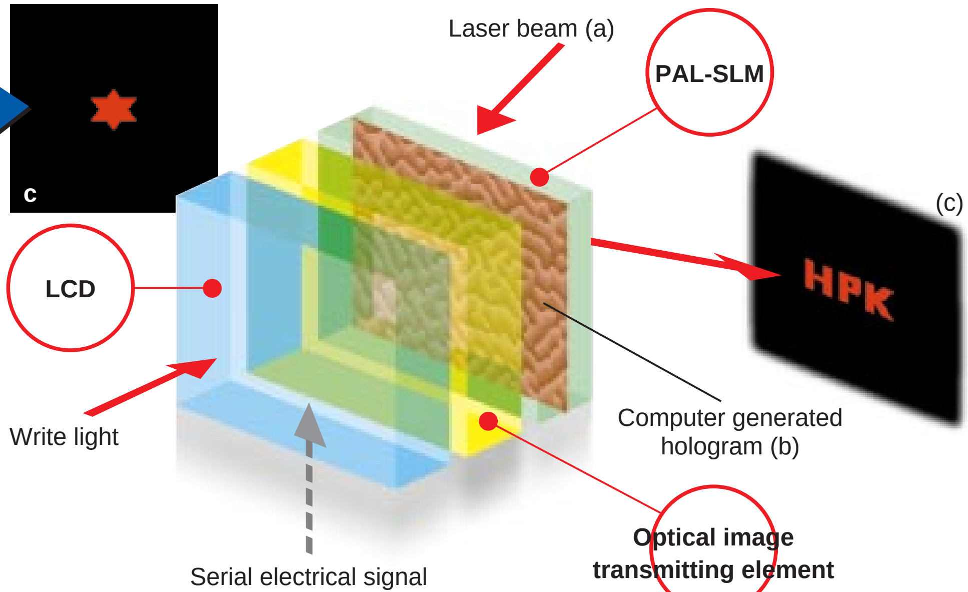



Fig. 1:
Computer-generated two-dimensional data is conveyed through a liquid crystal display and written to the PAL-SLM as a variable hologram (b), where it is then irradiated with laser light (a) to create the needed beam shape ("HPK" and the star in this case (c)). Light can be utilized with greater efficiency because of the optimized optics system design, which does not transfer the pixel structure of the liquid crystal display into the SLM, and the phase modulation characteristics of the PAL-SLM.




Optical computers are producing dramatic improvements in the speed and quality of optical information processing. A number of approaches are being adopted, including digital, analog, and neural. At Hamamatsu Photonics, we are working with analog optical computers, which use optical phenomena called Fourier transforms and holography, to develop devices and modules applying these phenomena, and to develop specific usage applications.

Our basic device, called the "PAL-SLM", is the world's first to use a parallel-aligned nematic liquid crystal as an optical address spatial light modulator. Because it allows modulation exclusively of the phase of the light, without affecting the amplitude, a high diffraction efficiency can be achieved. This can then be applied in optical correlators and other devices.

In the latest phase of our work, we have coupled a liquid crystal display with the PAL-SLM. We are currently working on application examples in which computer-generated two-dimensional data is transferred through the liquid crystal display and written to the PAL-SLM as a variable hologram which is then irradiated with light, enabling only the needed two-dimensional data to be extracted. For instance, in industrial applications, the PAL-SLM can be irradiated with laser light and optical spatial waveform shaping carried out to produce beam shapes tailored to the processing or marking task at hand. This method allows almost all of the irradiated optical energy to be converted to output light, depending on the data written to the hologram, and virtually eliminates light loss.

Optical interconnections are another example of a variable hologram in which computer signal delays are eliminated. Varying the written hologram on a time basis enables flexible connections with no physical restrictions. Possibilities are also being studied in numerous other practical applications, such as correcting wavefront disturbances caused by atmospheric fluctuation during astronomical observation.

Although research in optical computers has been underway for a decade, we are only now beginning to look at possibilities in industrial applications. As the motivating force behind those opportunities, we are exploring a broad range of needs and taking steps towards making this vital tool available for practical use.

Fig. 2
Exterior of the PAL-SLM

What mankind knows is still very little in the overall realm of knowledge, and there are endless subjects and possibilities that are not yet known or explored. We at Hamamatsu Photonics are committed, through the ongoing pursuit of truths which have not yet been clarified or defined, to achieving health and peace for all mankind.

Teruo Hiruma
President, Hamamatsu Photonics K.K.

Photon is our business


**HAMAMATSU PHOTONICS K.K.**

325-6, Sunayama-cho, Hamamatsu City, 430-8587 Japan
Telephone: (81) 53-452-2141, Fax: (81) 53-456-7889
URL http://www.hamamatsu.com