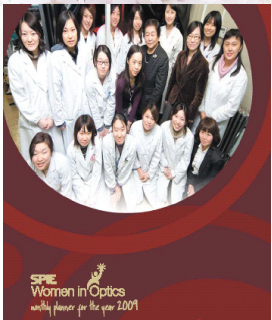


From micro optics to information photonics

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I have been engaged in basic theory, design, and fabrication in the field of micro-optics as well as applied fields in optoelectronics. I applied special features of diffractive optical elements that include ultrafast speed and parallel processing to new devices that I developed with my graduate students. One example is our design for the high dispersion VPH grism, installed in the Subaru telescope in Hawaii. We also built a face recognition system, called FARCO, using compact optical parallel correlation. An all-optical ultrafast image search engine is being developed for criminal identification and prevention of illegal downloading of motion pictures.

Web site: <http://spie.org/x17860.xml>

Why information photonics?

Speed.

-The possibilities of special purpose systems and massive parallelism give rise to high speed data processing.

Direct image processing.

-Images are transferred using naturally thought of in terms of optical systems and a laser beam.

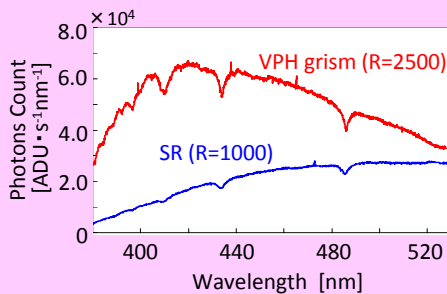
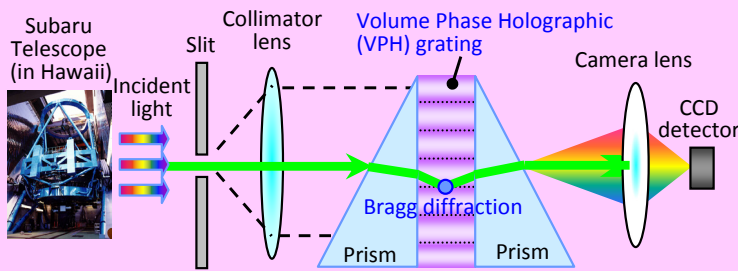
Massive parallelism and connectivity.

-The problems preventing the ultimate speeding up of conventional computers do not arise from the inadequate speed of the base elements.

Immunity to electromagnetic interference (EMI).

-The electrons circulating in a conventional computer are susceptible to electromagnetic interference.

Spectroscopic sensor for astronomical observation



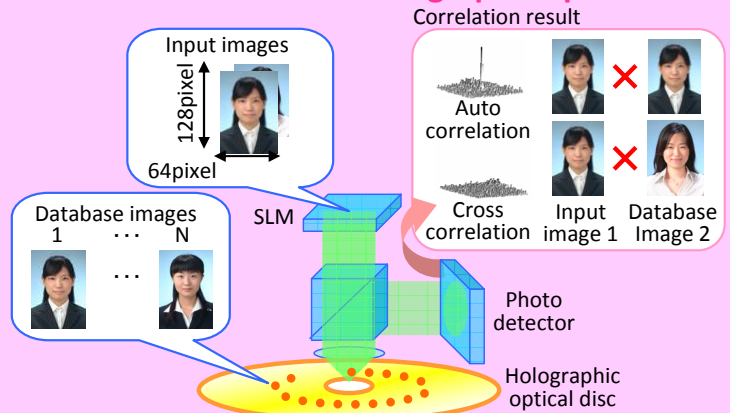
Performance of VPH grism

Diffraction efficiency: 84%
Wavefront accuracy error (rms): 0.4951

Standard star: G191B2B

Spectral observation of the VPH grism by Subaru Telescope 'FOCAS.'

High-speed optical correlator (FARCO 3.0) with holographic optical disk



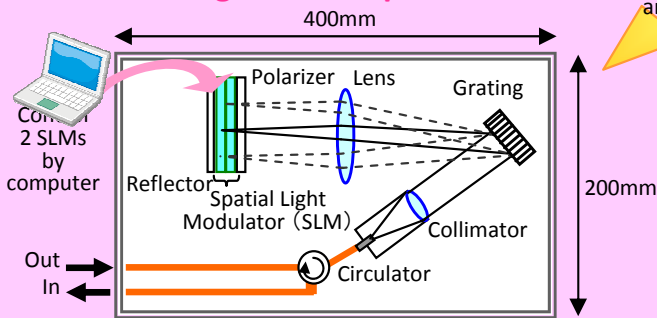
A huge amount of data can be stored in the holographic optical disc in the form of matched filter pattern. In the case of the correlation process an input facial image on the same positions is Fourier transformed by the same objective lens. As a result, the optical correlation process speeds up by simply rotating the disk at higher.

Optical total solution

Approaches by manufacturing and numerical analysis

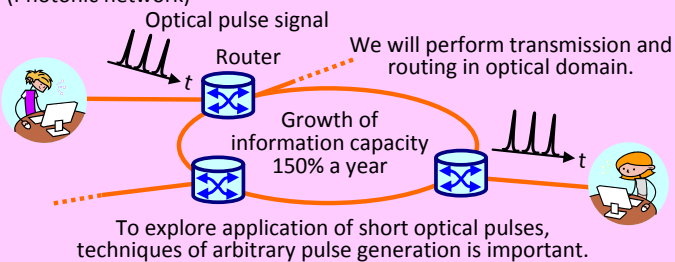


Spectrum signal processing using DOEs for next generation photonic network



Configuration of variable bandwidth spectrum shaper (VBS)

(Photonic network)



We will perform transmission and routing in optical domain.

Growth of information capacity 150% a year

To explore application of short optical pulses, techniques of arbitrary pulse generation is important.

VBS is control system of high-resolution and wideband spectrum for the future photonic networks.

The secret of the stone

(Vol. 447, June 14th, 2007)

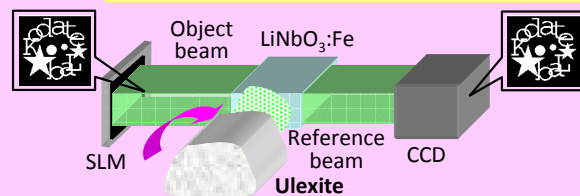
OPTICAL MEMORY
The secret of the stone

While casually sipping his Martini, a secret agent scans the glamorous guests filling the room. His eyes rest on an innocent-looking woman in a simple dress adorned with a single pale stone. Has he recognized that the stone is the key to all the information that is holding his adversary's evil organization together?

Yuko Ishii et al. would have recognized this hidden device. They have developed a holographic information storage system in which a piece of the mineral ulexite is a key component (Y. Ishii et al. Opt. Express 15: 7238-7232; 2007). As each stone is unique and irreproducible, only the stone that is used to store the information can retrieve it again. In holographic memory, information is stored optically in a light-sensitive crystal. An 'object' laser beam (containing information) produces an interference pattern with a reference beam, and the pattern is inscribed on the crystal. Information is retrieved again by using a third beam, in combination with the reference laser.

The beauty of the technique is that multiple images can be stored in the same volume, by slightly changing the settings of the reference beam at each recording step. Although it cannot yet beat magnetic disks in terms of price and performance, holographic data storage has its own advantages, and could become more competitive if its storage capacity could be improved. One way to achieve this is to use random reference beams, which can be generated by randomly rotating a diffuser in front of the reference laser. But this requires

a computer-controlled rotator and an algorithm to impose the randomness. Ishii and colleagues' approach is much simpler and more compact. They use a piece of ulexite as the diffuser and rotate it in regular steps. Because each piece of mineral has a unique composition, the random pattern of reference beams produced cannot be replicated by any other stone. Furthermore, only that stone can be used to retrieve the data. Ishii et al. demonstrate the effectiveness of the scheme by holographically storing images of a running figure and retrieving them as an animation with six frames per second (see figure). The authors note that the stone could be worn as part of an accessory and so be carried without attracting suspicion—except, that is, from a secret agent who has kept up with the scientific literature. **Liesbeth Venema**



All-optical projection system with rotating fieldstone

Promoting equal participation of men and women in science and engineering

As **Program Officer** at Japan Science and Technology, coming up with activities aimed at promoting equal participation of men and women in science and technology, the Gender Equality Office was founded, and the Basic Plan for promoting gender equality in science and technology was agreed in April 2006.

- Our activities include**
- Encouraging female researchers to apply for JST's Basic Research Programs (e.g. CRESTO, Sakigake, etc.)
 - Providing support for researchers who would like to return to research after having children / taking maternity leave (e.g. possible career breaks and extension of funding for projects)
 - Consultation for girls at secondary school level in making their choice in subject specialisation.

