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Subpicosecond photonic switching based on bacteriorhodopsin
PAL ORMOS, LASZLO FABIAN, ZSUZSANNA HEINER, Institute of Biophysics, Biological Research Centre, Hung. Acad. Sci., MARK MERO, HAS Research Group of Laser Physics, MIKLOS KISS, Department of Optics and Quantum Electronics, University of Szeged, ELMAR WOLFF, Institute for Applied Biotechnology and System Analysis at the University of Witten/Herdecke, KAROLY OSVAY, Department of Optics and Quantum Electronics, University of Szeged, ANDRAS DER, Institute of Biophysics, Biological Research Centre, Hung. Acad. Sci. — All-optical data processing is the most promising approach for further improvement in data trafficking. We present a subpicosecond photonic switch where the active role is performed by the chromoprotein bacteriorhodopsin. The changes in the refractive index that accompany the steps of the photocycle of bacteriorhodopsin are used for all optical switching in appropriate integrated optical devices. We use grating coupled planar waveguides and the coupling is modulated by the light induced refractive index changes of bacteriorhodopsin. The switching is demonstrated in ultrafast pump-probe experiments. Different transitions of the photocycle are explored for switching applications. We show that by using the bR to I transition subpicosecond switching can be readily achieved. The approach is a basis for protein-based integrated optical devices, eventually leading to a conceptual revolution in telecommunications technologies.

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