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Papers of interest from peer-reviewed Journals. Please note that registration on external sites may be required to access some abstracts.
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Links

- **Acoustically driven programmable liquid motion using resonance cavities**
Sean M. Langelier, Dustin S. Chang, Ramsey I. Zeitoun and Mark A. Burns
PNAS published online before print July 20, 2009, doi:10.1073/pnas.0900043106

As a step toward the development of a more efficient platform for microfluidic control, we present a distributed pressure generation scheme whereby independently tunable pressure sources can be simultaneously controlled by using a single acoustic source. We demonstrate how this scheme can be used to perform precise droplet positioning as well as merging, splitting, and sorting within open microfluidic networks. We further show how this scheme can be implemented for control of continuous-flow systems, specifically for generation of acoustically tunable liquid gradients. Device operation hinges on a resonance-decoding and rectification mechanism by which the frequency content in a composite acoustic input is decomposed into multiple independently buffered output pressures. The device consists of a bank of 4 uniquely tuned resonance cavities (404, 484, 532, and 654 Hz), each being responsible for the actuation of a single droplet, 4 identical flow-rectification structures, and a single acoustic source. Cavities selectively amplify resonant tones in the input signal, resulting in highly elevated local cavity pressures. Fluidic-rectification structures then serve to convert the elevated oscillating cavity pressures into unidirectional flows. The resulting pressure gradients, which are used to manipulate fluids in a microdevice, are tunable over a range of 0C200 Pa with a control resolution of 10 Pa.
(July 21, 2009)

- **Higher-Order Photon Bunching in a Semiconductor Microcavity**
M. Amann, F. Veit, M. Bayer, M. van der Poel, and J. M. Hvam
Science, 17 July 2009: 297-300

description of a light field must consider the properties of an assembly of photons instead of independent particles. The authors of this report studied multiphoton correlations up to fourth order in the single-mode emission of a semiconductor microcavity in the weak and strong coupling regimes. The counting statistics of single photons were recorded with picosecond time resolution, allowing quantitative measurement of the few-photon bunching inside light pulses. The results show bunching behavior in the strong coupling case, which vanishes in the weak coupling regime as the cavity starts lasing. In particular, we verify the n factorial prediction for the zero-delay correlation function of n thermal light photons.

- **Manipulation of photons at the surface of three-dimensional photonic crystals**
Kenji Ishizaki & Susumu Noda
Nature 460, 367-370 (16 July 2009) | doi:10.1038/nature08190

Photonic bandgap materials are envisioned to provide the necessary tools for guiding and manipulating photons in optical circuits. So far, basic approaches for photonic control have been based on embedding artificial defects and light emitters inside three-dimensional materials. Here it is demonstrated that three-dimensional photonic crystals possess two-dimensional surface states that can easily be manipulated to control photons, providing an alternative approach.

Y. L. Chen, J. G. Analytis, J.-H. Chu, Z. K. Liu, S.-K. Mo, X. L. Qi, H. J. Zhang, D. H. Lu, X. Dai, Z. Fang, S. C. Zhang, I. R. Fisher, Z. Hussain, and Z.-X. Shen
Science, 10 July 2009, Vol. 325. no. 5937, pp. 178 - 181, DOI: 10.1126/science.1173034

Topological insulators are a recently discovered state of matter, in which the bulk is an insulator while the surface is metallic with counterpropagating spin states. The surface states are protected by the topology, or structure, of the Fermi surface in the bulk gap and are described by a Dirac cone showing linear dispersion behavior meeting at the Dirac point. This report provides a comprehensive photoemission study on Bi2Te3 showing that it too falls into the category of topological band insulators. Moreover, there is just a single surface state with a single Dirac point in the photoemission spectrum. The identification of a material with a single Dirac point removes the ambiguity arising from multiple surface states and provides an ideal test-bed to probe the physics of these exotic new materials.

- **DNA sequence motifs for structure-specific recognition and separation of carbon nanotubes**
Xiaomin Tu, Suresh Manohar, Anand Jagota & Ming Zheng
Nature 460, 250-253 (9 July 2009) | doi:10.1038/nature08116

Methods for production of single-walled carbon nanotubes (SWNTs) generate mixtures of metallic and semiconducting tubes with different diameters and chiralities. However, many fundamental studies and technical applications of SWNTs require a population of tubes with identical chirality. A new method that is capable of purifying each species in a nanotube mixture is now demonstrated.

- **Three-dimensional nanopillar-array photovoltaics on low-cost and flexible substrates**
Zhiyong Fan et al.
Nature Materials, Published online: 5 July 2009 | doi:10.1038/nmat2493

In recent years, tremendous progress has been made in developing photovoltaics that can be potentially mass deployed. Of particular interest to cost-effective solar cells is to use novel device structures and materials processing for enabling acceptable efficiencies. In this regard, the present paper reports the direct growth of highly regular, single-crystalline nanopillar arrays of optically active semiconductors on aluminium substrates that are then configured as solar-cell modules. As an example, a

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