AUTHOR COMMENTARIES - From Special Topics

Photonic Crystals - October 2008
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Professor Jonathan Knight
From the Special Topic of Photonic Crystals

In our analysis of research on photonic crystals in the past decade, the work of Professor Jonathan Knight ranks at #3 by total cites, with 78 qualifying papers cited a total of 3,012 times. Two of these papers also appear on the list of the top 20 papers in this topic. In Essential Science Indicators*SM from Thomson Reuters, Prof. Knight's record includes 196 papers, the majority of which are classified in the fields of Physics or Engineering, cited a total of 6,371 times between January 1, 1998 and June 30, 2008.*

Prof. Knight hails from the University of Bath, where he is Head of the Department of Physics and member of the Centre for Photonics and Photonic Materials.

In the interview below, ScienceWatch.com *talks with Prof. Knight about his highly cited research on photonic crystals.*

SW: Please tell us a little about your research and educational background.

I did my Ph.D. in Cape Town, South Africa, during the dying years of the apartheid government. It was an exciting time and place to be in a liberal university environment, but very isolated both politically and geographically. The realization that one could communicate intellectually on a global scale through published work was a real eye-opener for me.

My Ph.D. was on microlasers, and I've been interested in trapping light in confined spaces ever since. I did postdoctoral research in Paris before moving to the United Kingdom in 1995.

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"Ph.D. student Jim Stone doing the work described in the recent Optics Express paper as described in the

SW: Your most-cited original paper in our analysis is the 2000 *IEEE Photonics Technology Letters* article, "Anomalous dispersion in photonic crystal fiber," (12[7]: 807-9, July 2000)? Would you talk a little bit about this paper's methods, findings, and conclusions?

The paper demonstrated that one could design and fabricate optical fibers with properties which had previously been unobtainable. We proved experimentally that a very simple model of the fibers gave reliable predictions of their properties. The paper had a big impact because it showed that very simple physics combined with a straightforward fabrication process opened the door to a range of

possibilities which had not previously been explored.

text."

SW: Based on the number of papers in your publication list, photonic crystal fibers are a prominent theme of your research. Why is this—what makes them so interesting to you and to the field at large?

Photonic crystal fibers are interesting for many reasons, but the one that always strikes me is that by forming microstructure in naturally occurring materials, one can create synthetic optical materials which have unique characteristics. We can relatively easily create optical effects which have probably not occurred before in the history of the universe! There is another side to the fiber work: optical fibers are an important part of our global society, and that makes research into them of interest both for applications and also for educational reasons.

SW: One of your more recent papers is the 2008 *Optics Express* article, "Visibly 'white' light generation in uniform photonic crystal fiber using a microchip laser," (16: 2670-5, 2008). Would you sum up this paper for our readers?

"Creativity is everything—we are only limited by our imaginations."

This paper shows how one can design a better supercontinuum fiber, and why it is better. Light traveling in these special fibers can change color as it travels, and a length of a few meters of fiber can transform an infrared laser beam into a brilliant rainbow of light spanning the visible and infrared. By modifying the fiber design, we show how to generate shorter wavelengths than before, extending into the ultraviolet. The design has been licensed to a laser company, and is already integrated into one of their products.

SW: How far has this work come since you entered the field? Where do you see it going in the next decade?

When I entered this field it was little more than an idea dreamed up by my colleague Philip Russell. It has become a well-funded and exciting research topic, with major efforts across the globe. There are great opportunities for doing novel nonlinear optics and atomic physics in new and unexplored environments, and I am sure some major discoveries remain to be made in this area. Some of the most exciting work at the moment is application-driven, because we have the chance to affect whole industries of the future. In particular, I expect to see an impact on biomedical analysis, and on laser design and use.

SW: What should the "take-home" lesson be about your research?

Creativity is everything—we are only limited by our imaginations. There are always new things to do, but although they are right in front of us they can be hard to see. I also believe that enjoying your work is vital, and if you are not having fun you should be doing something else.

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Prof. Jonathan Knight's current most-cited paper in *Essential Science Indicators*, with 473 cites:

Cregan RF, *et al*., "Single-mode photonic band gap guidance of light in air," *Science* 285(5433): 1537-9, 3 September 1999. Source: *Essential Science Indicators* from Thomson Reuters.

Keywords: photonic crystal fibers, optical fibers, synthetic optical materials, supercontinuum fiber, laser applications.

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