UNIVERSITA' DEGLI STUDI DI PAVIA

DOTTORATO DI RICERCA IN FISICA

COLLOQUIA 2015-2016

Seminari di Fisica della Materia

Giovedì 10 Marzo 2016
Aula 102 “L. Giulotto”, ore 16.00
Dipartimento di Fisica, via Bassi 6, Pavia

Hollow core optical fibers: a brief history and future perspectives

Walter Belardi

Optoelectronics Research Center,
University of Southampton (UK)

Abstract: Since the dawn of optical fiber technology, optical engineers and physicists have explored ways for reducing light signal attenuation in optical wires. The enormous steps made in optical fiber fabrication technology have allowed perfecting more and more the use of silica glass for conventional telecommunication fibers, which has finally led to the global optical network underlying the Internet, as we all know today.

However optical scientists of all times have never renounced of thinking to different ways for guiding light in optical wires. In this talk we will review the history of hollow core optical fibres and outline the progress made in the design and fabrication of these unconventional optical fibers in unconventional optical spectrum domains. These novel optical fibres may be able to allow data communication at almost the speed of light in vacuum or allowing the delivery of extremely high optical power.

UNIVERSITA' DEGLI STUDI DI PAVIA

DOTTORATO DI RICERCA IN FISICA

PhD Course "Photonics", a.y. 2015/2016

Dr. Walter Belardi

Optoelectronics Research Center,
University of Southampton, U.K.

will give a series of lectures on

Microstructured Optical Fibers

Lectures will be given at the Physics Department, via Bassi 6, with the following schedule:

Tuesday 8 March, 11-13 (aula dottorato)
Wednesday 9 March, 9-11 (aula dottorato)
Thursday 10 March, 16-17 (seminar, aula 102**)**

Interested students are welcome to participate. Please contact the course coordinator (L.C. Andreani, lucio.andreani@unipv.it) for further information.

UNIVERSITÀ DI PAVIA
DOTTORATO DI RICERCA IN FISICA

PhD Course “Photonics”, a.y. 2015/2016

Lectures by Walter Belardi (ORC Southampton)

Lesson 1 (Tuesday 8 March, 11-13, aula dottorato of the Physics Department)

Title: “Microstructured Optical Fibers”

Objective: Understanding the main characteristics and applications of Microstructured Optical Fibers (MOFs).

Requirements: Basics of ray optics.

Outline of the Lesson: After a short introduction on optical fibers, the basic concepts underlying MOFs are treated and in particular their difference with conventional optical fibers. The lesson follows the historical path which led from the discovery of the novel properties of MOFs to their use in optical sensors and laser sources.

Bibliography:

- Bjarklev, J. Broeng, A. Sanchez Bjarklev, “Photonic Crystal Fibres” (Springer, 2003)

*- P. St. J. Russell, Photonic crystal fibers, Science **299**, 385−362 (2003)*

*- J. C. Knight, Photonic crystal fibers, Nature **424**, 847-851 (2003)*

*- P. St. J. Russell, "Photonic-Crystal Fibers," Journal of Lightwave Technology **24**, 4729-4749 (2006)*

Lesson 2 (Wednesday 9 March, 9-11, aula dottorato)

Title: “Novel Optical Fibers”

Objective: Getting a glimpse of some of the most recent research activity in the field of novel optical fibers.

Requirements: Basics of ray optics and optical fibers. Lesson 1 on microstructured optical fibers.

Outline of the Lesson: Some examples of the most recent research activities on new optical fibers are discussed. This includes the novel properties and applications of *multimaterial fibers*, *semiconductor fibers* and *antiresonant fibers*. A view on the actual state of the art and a general outlook is provided.

Bibliography

*M. A. Schmidt, A. Argyros, F. Sorin, “Hybrid Optical Fibers “An innovative platform for In-Fiber Photonic Devices”, Advanced Optical Materials, **4**, 12 (2016)*

*F. Abouraddy, M. Bayindir, G. Benoit, S. D. Hart, K. Kuriki, N. Orf, O. Shapira, F. Sorin, B. Temelkuran & Y. Fink, “Towards multimaterial multifunctional fibres that see, hear, sense and communicate”, Nature Materials **6**, 336 (2007)*

*A. C. Peacock, J. R. Sparks and N. Healy, “Semiconductor optical fibres: progress and opportunities”, Laser & Photonics Reviews **8**, 53 (2014)*

*W. Belardi, “Design and properties of hollow antiresonant fibers for the visible and near infrared spectral range” Journal of Lightwave and Technology **33**, 4497 (2015)*

Seminar within Physics PhD Colloquia

Thursday 10 March, 16-17, aula 102

Title: “Hollow core optical fibers: a brief history and future perspectives”

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Biography

Dr Walter Belardi is a senior research fellow at the Optoelectronics Research Centre (ORC), University of Southampton (United Kingdom).

He was awarded his Laurea degree in Electronics Engineering at the *Università degli Studi di Pavia* and his PhD degree in Optoelectronics at the ORC with a thesis on “Holey optical fibres for high nonlinearity devices”. His principal research contributions are in the design, fabrication and use of novel optical fibre technologies. He has co-authored more than 80 scientific publications and 2 patents. His most important personal achievements range from the first application of the spinning technique to MOFs, the first inclusion of an elliptical hole within a MOF, the invention of a double clad fabrication approach for MOFs, to the most recent results on hollow core optical fibres. These include theoretical studies on their geometrical structure, the introduction of a radically novel design for low loss hollow core optical fibres, the first theoretical and experimental demonstration of low bending loss in hollow antiresonant fibers and the demonstration of the lowest ever attenuation in a hollow core fibre below 500nm.

More details about his research are on his blog: www.walterbelardi.com