

## **Professor YARON SILBERBERG**

### **EDUCATION**

1984            PhD, Physics, Weizmann Institute of Science, Rehovot, Israel  
1975            MSc, Physics, Weizmann Institute of Science, Rehovot, Israel  
1972            BSc, Physics, Tel-Aviv University, Tel-Aviv, Israel

### **CURRENT POSITION**

1999 –            Professor, Physics of Complex Systems, Weizmann Institute of Science  
                         Rehovot, Israel

### **PREVIOUS POSITIONS**

1994 – 1999    Assoc. Professor, Physics of Complex Systems, Weizmann Institute of  
                         Science, Rehovot, Israel  
1985 – 1994    Member of Technical Staff, Bellcore, New Jersey, USA  
1984 – 1985    Postdoctoral Member of Staff, Bell Laboratories, New Jersey, USA

### **INSTITUTIONAL RESPONSIBILITIES**

2008 –            Head, Crown Photonics Centre, Weizmann Institute of Science, Rehovot  
2002 – 2008    Dean, Faculty of Physics, Weizmann Institute of Science, Rehovot, Israel  
1999 – 2002    Chair, Dept. of Complex Systems, Weizmann Institute of Science,  
                         Rehovot

### **COMMISSIONS OF TRUST (recent)**

2015 –            Member of the Board, Technion – Israel Institute of Technology, Haifa,  
                         Israel  
2015 –            ERC Special Review Workgroup on the ERC Synergy program  
2014 –            Editorial Board, Journal of Physics B, IOP, UK  
2012 –            Review Board, DFG Excellence Initiative Program, Germany

### **AWARDS**

- Member, Israeli Academy of Sciences and Humanities
- Weizmann Prize in Exact Science, Israel, 2015
- Max Born Award of the Optical Society of America, 2013
- Landau Prize in Exact Sciences, Israel, 2011
- Advanced ERC Grant “Quami”, 2011-2016
- Chair, GRC on Nonlinear Optics (1995), GRC on Quantum Control (2009)
- Fellow of the Optical Society of America, 1991

## GROUP ALUMNI:

### *PhD students now in Academic Positions:*

Hagai Eisenberg (Hebrew U., Jerusalem)  
Dvir Yelin (Technion, Haifa) \*  
Nirit Dudovich (Weizmann, Rehovot) \*  
Dan Oron (Weizmann, Rehovot) \*  
Avi Pe'er (Bar Ilan, Ramat Gan)  
Barak Dayan (Weizmann, Rehovot)  
Haim Suchowski (Tel Aviv U, Tel Aviv) \*  
Adi Natan (SLAC, US)  
Ori Katz (Hebrew U, Jerusalem) \*  
Eugene Frumker (Ben Gurion U, Beer Sheva)  
Yaron Bromberg (Hebrew U, Jerusalem)

\* Winners of ERC starter/consolidator grants

### *Postdocs now in Academic Positions:*

Moshe Horowitz (Technion, Haifa)  
Roberto Morandotti (INRS, Montreal, Canada)  
Vaibhav Prabhudesai (ITFR, Mumbai, India)  
Barry Bruner (Staff Sci., Weizmann)  
Sunil Kumar (ITT Delhi, India).

## MAJOR CONTRIBUTIONS BY THE GROUP

Sub-picosecond pulses from a semiconductor laser (1984)  
The Digital Optical Switch - an adiabatic integrated optics switch (1987).  
Spatial solitons in planar optical waveguides (1989).  
Light bullets - spatiotemporal collapse of optical pulses (1990)  
A liquid-crystal based switching device for WDM systems (1993).  
Third-Harmonic Generation Microscopy (1997).  
Adaptive pulse compression and shaping. (1997)  
Coherent control of two-photon transitions (1998).  
Discrete Spatial Solitons (1998)  
Single-pulse CARS microscopy (2002).  
Nonlinear optics with single photons (2005).  
Shaping of single photons (2005).  
Temporal Focusing Microscopy (2005).  
Anderson Localization in waveguide arrays (2008).  
Quantum optics in waveguide arrays (2009).  
High NOON states (2010).  
Looking around corners - wavefront shaping (2012).  
Non-invasive Microscopy through scattering layers (2014)

## RESEARCH PROFILE

After a short postdoctoral period at Bell Laboratories, I started my independent research career as a Member of Staff at Bellcore in New Jersey, where I focused mainly in the field of nonlinear optics, in particular nonlinear guided-wave and fibre optics. I proposed and initiated the first studies of **spatial optical solitons**, an area that became a very active field for me and many others; Spatio-temporal effects in nonlinear optics, and in particular the idea of **light bullets**, were some of the main themes I studied.

After joining the Weizmann Institute in 1994 I kept a leadership role in nonlinear optics. The experimental demonstration of **discrete solitons** started a very intense worldwide effort in nonlinear properties of periodic systems and photonic lattices. The analogy between photons in periodic optical systems and electrons in condensed matter makes these systems ideal for observing quantum wave phenomena such as **Bloch oscillations**, **Anderson localizations** etc., while nonlinearities enable to explore interactions in such systems.

In parallel, I started an experimental effort in **quantum coherent control**, which is the area relevant for this proposal. We have demonstrated the power of quantum control by carefully crafted femtosecond pulses on **two-photon absorption** and **Raman interactions** in atomic and molecular systems. In parallel, we have developed a new research effort in **nonlinear microscopy**, pioneering and patenting new techniques such as **third-harmonic generation microscopy** and **temporal-focusing microscopy**. We combined coherent control ideas with femtosecond pulse shaping to develop the technique of **single-pulse CARS microscopy**, where crafted pulses enabled high spectral resolution in spite of their broad spectral width. Most relevant here is also our recent breakthrough in **two-dimensional Raman spectroscopy**, where coherent control techniques help to overcome fundamental hurdles for implementing this technique.

Motivated by our interest in imaging and microscopy, we are also investigating the **interaction of light with complex media**, and techniques to mitigate random scattering. Using **wavefront shaping** and nonlinear optical principles, we have demonstrated various techniques related to **imaging through scattering** layers.

Finally, we are also conducting a vigorous program in **quantum optics**, translating concepts of ultrafast coherent control into nonclassical light, for example, for **shaping of single photons** and the generation of nonclassical light such as **high-NOON states** and the study of **quantum random walks** in optical lattices.

For more details and full list of publications, see <http://www.weizmann.ac.il/complex/silberberg>