

## Research Profile



**First Name:** Nouredine    **Middle Initial:**    **Last Name:** Melikechi  
**Title:** Director of the Applied Optics Center of Delaware and Professor of Physics  
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### Professional Education:

- University of Sussex (England), D. Phil in Physics, 1987. Thesis title: *The Role Of Real Intermediate States In Two Photon Absorption.*
- University of Sussex (England), M.Sc. in Physics, 1982. Thesis title: *Laser Spectroscopy In A Thermal Sodium Atomic Beam.*
- University of Sciences and Technology (Algiers, Algeria), D.E.S. (Diplôme d'Études Supérieures) in Physics, 1980.

### Research Interest Area(s):

Dr. Nouredine Melikechi, has more than 20 years of experience in the field of optics and laser spectroscopy. Dr. Melikechi has worked on precise pulsed laser spectroscopy of few-electron systems ( $H_2$ , HD,  $D_2$ ) in the visible and the far ultraviolet, on the generation of vacuum ultraviolet radiation, and development of Fourier-transform limited laser pulses. This research played a major role in the development of a new experimental scheme for pulsed-laser frequency-modulation spectroscopy that resulted in a direct absorption measurement in the (1-0) band of the gamma system of NO. Dr. Melikechi has also developed frequency-mixing schemes with single frequency lasers, and has studied optical phase distortions due to laser amplification and second-harmonic-generation. While at the University Paul Sabatier in Toulouse, France as an invited Professor, Dr. Melikechi worked on femtosecond laser spectroscopy. Using two identical coherent femtosecond laser pulses slightly delayed in time with respect to each other, optical and quantum interferences were clearly distinguished for the first time in an atomic system.

Further, Dr. Melikechi has focused his efforts on investigations of second-harmonic generation processes in quasi-phase-matched waveguides and on optical techniques to enhance optical coupling efficiency in fibers. Currently Dr. Melikechi is working on the development of novel and sensitive optical techniques that will be used to characterize complex samples i.e. samples that exhibit a large number of optical phenomena. We are investigating the use of photothermal laser spectroscopic techniques and laser induced plasma spectroscopy to analyze biological samples. In collaboration with researchers at the Fox Chase Cancer Center, we are using sensitive optical techniques to evaluate molecular markers present during the neogenesis of ovarian cancer cells. Our goal is to develop spectroscopic techniques to monitor the progression and underlying molecular mechanisms of ovarian disease.

### Active Grants & Funding:

- "Application of Laser Induced Breakdown Spectroscopy and Quantum Dots for the Elemental Analysis of Blood: A Feasibility Study" In collaboration with the Fox Chase Cancer Research Center. September 2005- March 2006. Funding agency: NIH.
- "Developing a Relationship between Delaware State University and CBST through the Applications of Novel Optical Detection Techniques in Biology and Medicine" in collaboration with Center for Biophotonics Science and Technology, University of California at Davis. July 2005- July 2006. Funding agency: NSF.
- "Detection and diagnosis of early ovarian cancer using novel sensitive optical techniques" in collaboration with Denise Connolly, Fox Chase Cancer Center. March 2006- March 2009. Funding agency: DOD.
- "Pulsed thermal lens laser spectroscopy of atmospheric species" Submitted to NASA, Delaware Space Program.

**Professional Affiliations:**

- Member, American Physical Society
- Member, Optical Society of America
- Member, Emerging Technology Council, State of Delaware
- Board Member, Delaware Authority on Radiation Safety

**Honors & Awards Received (last five years):**

- SMART (Strengthening the Mid-Atlantic Region for Tomorrow) Award (2006) See: <http://www.smartstates.com/News/tabid/58/Default.aspx>

**Publications (Last three years):**

Laser Spectroscopy of atoms and small molecules

A. Yiannopoulou, *N. Melikechi*, S. Gangopadhyay, J.-C. Meiners, and E.E. Eyler, "Precise Measurement of  $EF^1\Sigma^+_g$  Levels in  $H_2$ ,  $D_2$ , and HD." Phys. Rev. A73, 1 (2006).

Nonlinear optics

*N. Melikechi* "Coherent blue light generation: quasi-phase-matched second harmonic generation in  $KTiOPO_4$  waveguides" in *Integrated Optical Devices, Nanostructures, and Displays*. Edited by Lewis, Keith L. Proceedings of the SPIE, **5622**, pp. 460-465 (2004). **Optical fiber coupling**

K. Amara and *N. Melikechi* "Coupling efficiency effects of launching a fringe pattern into a single mode optical fiber" JOSA B 20, 2031-2036 (2003).

Laser Spectroscopy: Techniques

D. Comeau, A. Hache and *N. Melikechi* "Reflective thermal lensing and optical measurement of thermal diffusivity in liquids" Appl. Phys. Letts. 83, 246 (2003)