



## Dynamically Tunable Visible and IR Structural Colors

**Debashis Chanda, Ph.D.**

Professor, NanoScience Technology Center,  
Department of Physics, CREOL, College of Optics and Photonics  
University of Central Florida

**Abstract:** Structural coloration offers many advantages over conventionally used pigment-based colors due to their non-toxic, fade-resistant, and environmentally friendly nature. These colors arise from the structural arrangements of colorless materials at the nanoscale, which create optical resonances and vibrant hues. Over the last decade, dynamic color generation has been the subject of extensive research across various scientific disciplines. However, commercial adoption has been limited by the absence of effective tuning mechanisms, structural complexities and fabrication challenges. In this work, we demonstrate active color tuning based on phase modulation of a multilayer stack composed of a phase-changing material (PCM) and a high-index material on a reflective surface both in the visible and long wave infrared domains (LWIR). We elucidate the underlying interfacial and cavity phase modulation mechanisms responsible for the dynamic color changes, highlighting the potential for tailoring the optical properties of this thin-film stack for a wide range of practical applications. Furthermore, we showcase the lithography-free implementation of this concept for large-area, color-tunable textiles, complex surfaces, and temperature sensitive consumer product labeling, highlighting its efficacy in tunable, scalable, and sustainable coloration. Leveraging dynamic phase modulation, this concept holds immense promise for applications in thermal sensing, advanced textile engineering, camouflage, and reconfigurable displays.

**Bio: Prof. Debashis Chanda** is a Professor, jointly appointed with NanoScience Technology Center, Dept. of Physics and College of Optics and Photonics (CREOL), University of Central Florida (UCF). Dr. Chanda received his PhD from University of Toronto. His PhD work was recognized in the form of several awards, including prestigious National Sciences and Engineering Research Council (NSERC) fellowship. Dr. Chanda completed his post-doctoral research with Prof. John A. Rogers at Beckman Institute, University of Illinois at Urbana-Champaign. Most of his research works were extensively covered by National Science Foundation news, BBC, Daily Mail, NBC, Fox, Science Radio and other national/international media outlets. His research has appeared on American Scientist magazine as focused article where it was outlined how companies like Intel, Toshiba etc are trying to adopt some of the printing techniques which were developed in his group. Dr. Chanda is a recipient of the 2012 DOE Energy Frontier Research Center (EFRC) Solar Energy Future Direction Innovation Proposal Award, International Displaying Future Award-2016 by Merck Germany, UCF Research Incentive Award (2017), UCF Reach of the Stars Award (2018), UCF Luminary Award (2020), Samsung Global Research Outreach (GRO) Award (2022), Sony Research Award (2022), UCF Research Incentive Award (2025), UCF College of Science Oscar Award (2026), UCF Trustee Chair Award (2026). Dr. Chanda's research has been supported by NSF, DoD, DARPA, Florida Space Institute/NASA, Northrop Grumman, Lockheed Martin etc. Apart from that Dr. Chanda is the founder of start-up, E-Skin Displays Inc., out of his research in California.

**Hosted by:** Prof. Alon Gorodetsky