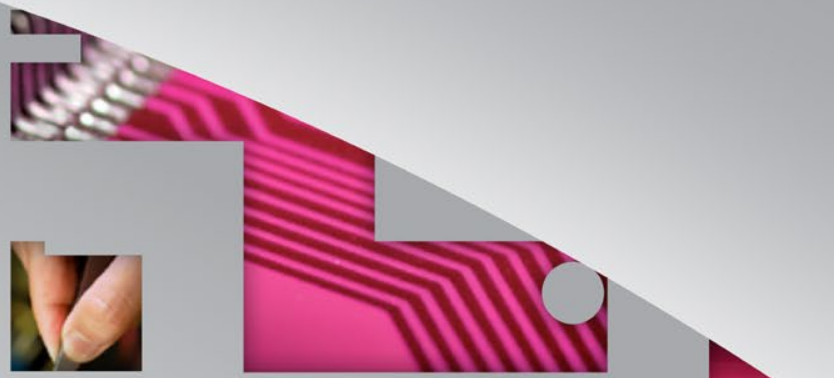
Department of Electrical and Computer Engineering

MERGING LEARNING AND INNOVATION TO SERVE THE NEEDS OF THE STATE, THE NATION, AND THE GLOBAL COMMUNITY



UNIVERSITY OF MARYLAND 18 56

A. JAMES CLARK SCHOOL OF ENGINEERING

Overview

Educational Updates:

- Computer Engineering Program Updated
- BS in Embedded Systems and Internet of Things
- Professional MS in Machine Learning

Faculty Awards:

- Significant Grants and Contracts
- Special Recognition and Publications

Plans

- Hiring Plans
- Academy of Machine Learning
- Instructional and Research Labs

Computer Engineering: Current Curriculum

- ENEE 205 – Electric Circuits
- ENEE 244/245 – Digital Circuits
- ENEE 303/307 – Analog and Digital Electronics
- ENEE 222 – Signal Analysis
- ENEE 322 – Signal and System Theory
- ENEE 324 – Engineering Probability
- ENEE350 – Computer Organization
- ENEE 446 – Digital Computer Design
- CMSC 131/132 – Object Oriented Programming
- CMSD 216 – Introduction to Computer Systems
- CMSC 250 – Discrete Structures
- CMSC 330 – Organization of Programming Languages
- CMSC 351 – Algorithms
- CMSC 412 – Operating Systems

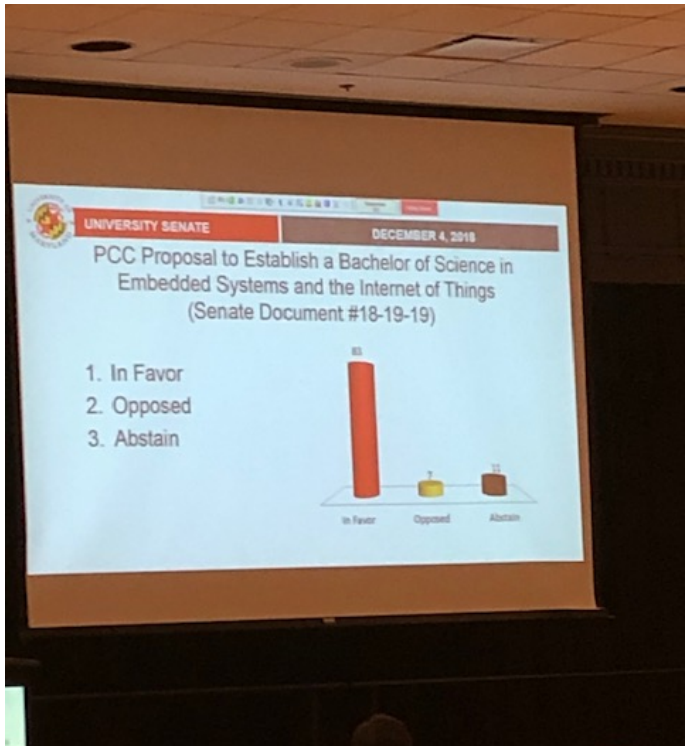
17 required courses (10 ENEE, 7 CMSC)

Program Changes

- Reduce the number of required ECE courses by three
- Provide flexibility to choose courses earlier in the major
- Increase the number of 400-level courses, and allow the possibility of different tracks:
  - CIRCUITS
  - SYSTEMS
  - COMPUTING: SOFTWARE AND HARDWARE

BS in Embedded Systems and IoT

- Biomedical Science & Engineering Education (BSE) facility at Shady Grove to be ready Spring 2019.
- BSES program approved by all the relevant campus committees – with *Presidential approval on 12/13/2018*!
- Next and final step at the University System.



Courses and Labs to be fully developed in the next 6-9 months

Professional MS in Machine Learning

- **Joint with Computer Science – Approved by both departments.**
- **Degree Requirements:**
  - 30 CREDITS TOTAL: 6 CORE COURSES, 4 ELECTIVES, SCHOLARLY PAPER
- **Currently under discussions between the two Deans – Will be offered starting Fall 2019.**

Overall MS Program

- Core courses:
  - MSML 601: Probability and Statistics
  - MSML 602: Introduction to Optimization
  - MSML 603: Computing Systems for ML
  - MSML 604: Algorithms and Data Structures for ML
  - MSML 605: Applied Machine Learning
  - MSML 606: Data Science
- Electives:
  - ENML 610: Advanced Machine Learning
  - ENML 612: Deep Learning
  - ENML 620: Estimation and Detection
  - ENML 621: Digital Signal Processing
  - ENML 630: Numerical Methods
  - ENML 640: Computer Vision
  - ENML 650: Cloud Computing
  - ENML 651: Big Data Analytics

Significant Faculty Awards– NSF

- **Waks:** Development of scalable quantum networks
- **Simon/Babadi**: Extracting Functional Cortical Network Dynamics at High Spatiotemporal Resolution
- **Waks/Dagenais** and partner institutions Duke, Stanford; Development of Scalable Quantum Networks Using Ion Chips and Integrated Photonics
- **Murphy**: Development of Ultrafast Near-Field Scanning Optical Microscope.
- **Shoukry/Krishnaprasad:** Resilient cyberphysical systems
- **Barg:** information recovery
- **Shamma/Espy-Wilson:** neuromorphic speech segregation
- **Ulukus:** data-driven medical devices
- **Dachman-Soled:** Post-quantum crypto
- **Ephremides:** Age of information
- **Ghodssi:** devices to combat biofilms

Significant Faculty Awards – Other Sources

- **Manocha:** Semi-autonomous swarm tactics for situational awareness in uncertain environments (DARPA)
- **Marcus/ Babadi/Simon** - An Optimization-Based Approach to Breaking the Neural Code (DARPA)
- **Waks:**Tunable Laser System & Low-Temperature Magneto-Optical Microscope (DURIP)
- **Khaligh**: Compact and Low-Cost Microinverter for Residential Systems, (DOE)
- **Shamma:** Research coordination network (NIH)
- **Bhattacharrya:** real-time decoding of calcium imaging (NIH)
- **Babadi** – part of a $20M NIH Brain initiative grant.

Faculty Recognition

- Distinguished University Professors: John Baras and Isaak Mayergoyz.
- AIAA Aerospace Communications Award and Fellow of the AMS: John Baras
- DARPA Young Faculty Award: Jeremy Munday
- Papers in Nature (Munday, Hafezi), Science (Waks), PNAS (Chellappa, Babadi, ..), *Cover of ACS Photonics* (Munday), *Current Biology* (Simon), *Applied Energy* (Khaligh), ..

New Hire: Prof. Yanne K. Chembo

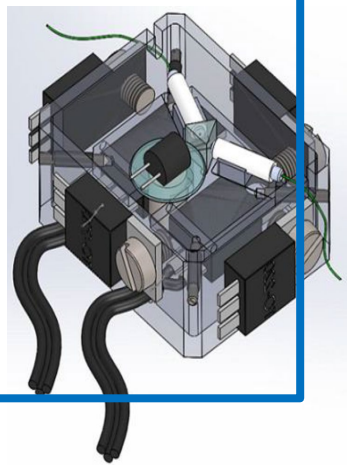
PhD Physics (2001-2005), Univ. of Yaoundé, Cameroon
PhD Photonics (2002-2006), IFISC, Palma de Mallorca, Spain

2010-2016: CNRS Research Scientist, France
2017-2018: CNRS Research Scientist, GeorgiaTech-CNRS Joint International Lab,.
Since 2018: CNRS Research Director, GeorgiaTech-CNRS Joint International Lab

- SPIE Fellow
- European Research Council Fellow (ERC: most competitive and prestigious grant in Europe; ~2M$)
- NASA Invention and Contribution Board Award
- NASA Postdoctoral Program Fellow (Only ~50 grants/year in the world)

Aerospace Engineering

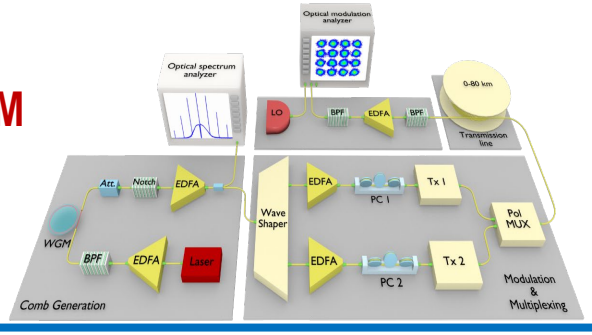
- Ultra-low phase noise optoelectronic oscillators
- Kerr optical frequency comb generation



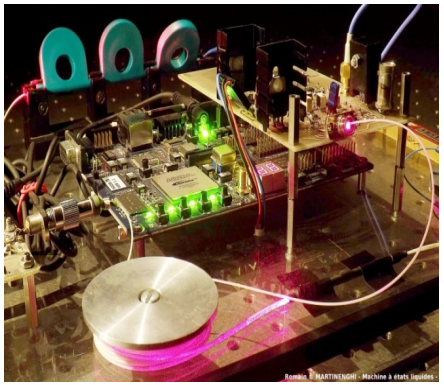
Telecommunication Engineering

- Optical chaos communications
- Wavelength division multiplexing using Kerr combs

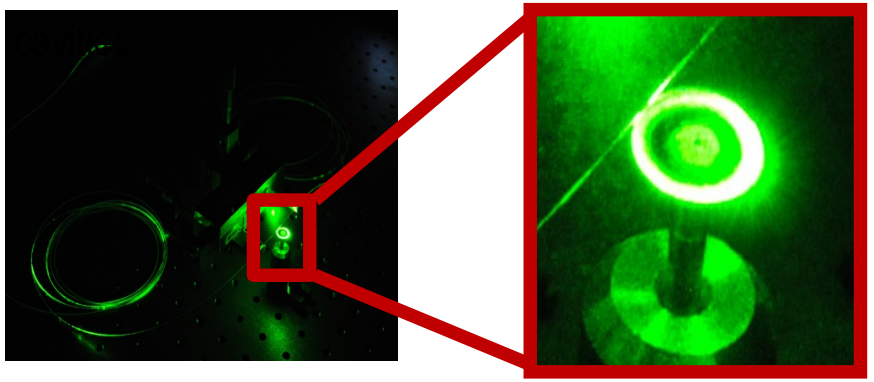
>400 Gbit/s using 16QAM



Photonic Neuromorphic Computing



Nonlinear and Quantum Photonics



Community & Outreach

New-York

Member of the delegation that successfully defended the 2015 International Year of Light (IYL) project at the United Nations Headquarters

Paris

Member of the delegation at the UNESCO Headquarters

Munich

Every May 16th:
International Day of Light

United Nations Educational, Scientific and Cultural Organization

International Day of Light

Faculty Search

- Two positions in Quantum Computing
  - Provost supported initiative to establish the Quantum Technology Center (QTC), joint with Physics.
  - Search Committee: E. Waks (Chair), M. Hafezi, M. Dagnais, K. Daniels, J. Goldhar, Trey Porto (Physics), and Lourdes Salamanca-Riba (Materials).
- Over 123 Applicants so far – Interviews in the Spring.
- Additional Possible Senior Hire in Cybersecurity joint with CS

Other Plans for Spring 2019

- Academy of Machine Learning – more later
- Enhancement of research and instructional infrastructures (4 research labs, 3-4 instructional labs + 4 labs at Shady Grove)
- Developing the staffing and the courses for the Shady Grove program
- Strengthening our industrial collaborations