



## AIM Winter Academy 2018

Silicon Photonics: Fundamentals of Chip Fabrication  
MIT, January 16-18, 2018

AIM Winter Academy teaches the design fundamentals for integrated photonics from three distinct perspectives: device physics, circuit layout, and manufacturing variation. The program offers a holistic methodology for conceptualizing a photonic integrated circuit (PIC) for a systems application, and plan a circuit design that relies upon the standardized process design kits used in current chip fabrication process flows. The program is arranged for participants with no prerequisite expertise in photonics theory or practice, and challenges them to engage at a conceptual level with the design of critical device components in application-specific PICs. These design exercises address leading edge manufacturing challenges.

**Day 1** of Winter Academy introduces attendees to the scaling drivers that are accelerating the adoption of PICs for four diverse applications, and the fundamentals of materials, optical properties, and system performance budgets. The day continues with a review of the passive devices necessary for building a PIC transceiver, and concludes with a description of the process flow for manufacturing a multi-layer PIC comprised of a heterogeneous set of materials with disparate thermal, mechanical, optical, and electrical properties. **Day 2** continues the device review with an in-depth study of the modulator and detector for a transceiver; on-chip light source solutions will be briefly surveyed. The procedure for submitting to a Multi-Project Wafer (MPW) run is reviewed, and the Process Design Kit (PDK) is introduced as an enabling new methodology for fabless manufacture of a PIC, and how compact modeling of a Mach-Zehnder Interferometer versus a ring modulator reveal diverging device performance metrics, that are well-suited to different PIC applications. PIC devices are re-envisioned as components described by compact models, comprised of both an optical layer and electrical layer for real-time feedback control. **Day 3** addresses the fabrication constraints of foundry facilities that follow this device design and process flow, by describing a manufacturing methodology that incorporates design variation assessment into the PDK.

Each day will conclude with an extended **Design Lab** activity in which attendees will have the unique opportunity to solve a PIC design problem with expert representatives from six major Electronic-Photonics Design Automation (EPDA) companies that are collaborating with AIM Photonics to develop a comprehensive design process flow for fabless photonics. The Design Labs charge attendees to put into action the device, circuit, and manufacturing principles taught during the lecture sessions.

AIM Winter Academy is a gateway course that prepares attendees for taking a two-sequence edX course on PIC design (to be launched in spring, 2018) for test in collaboration with the AIM Photonics 300mm MPW facility in Albany. Attendees will also be prepared to avail of subsequent online learning modules (to be published in summer, 2018) that will train them for engagement with the AIM Photonics Package, Assembly and Test facility in Rochester, NY.