Engineering Student Technology Committee

http://www.engr.colostate.edu/ESTC

College of Engineering

Colorado State University

1. Title of Proposal: Automated Testing Station for Silicon Photonics IC Characterization

2. Proposal Participants:

Primary Contact for Proposal

Name: **Dr. Mahdi Nikdast**_____E-Mail: **Mahdi.Nikdast@colostate.edu** ___

Department/Major: **Electrical and Computer Engineering (ECE)** _____

Check One: ____X **Faculty** _____ **Staff** _____ **Student**

3. Proposal Abstract (limit to 100 words):

Silicon Photonics has emerged as a leading technology in several areas, including embedded systems, communications, aerospace, etc. For the first time, *CSU students from different departments* will get hands-on experience on this technology through a new experimental course, ECE580B6. This proposal asks for cost sharing from ESTC for purchasing a fundamental equipment required to test and characterize silicon photonics chips *students* design and fabricate in this course and in CSU research labs working on this area. Having access to this equipment will make CSU stand among a few schools in the world that provide access to such facility to their students.

4. Proposal Budget

List of items to purchase and cost of each

Multi-die/wafer platform automated probe station: $60,000 to $75,000 (depending on different configurations).

Dollar or percentage amount requested from ESTC: ***$10,000 (16% to 13%)***

5. Full description of proposal:

Silicon photonic integrated circuits (PICs) are emerging as one of the most promising new technologies in several areas, including embedded systems, communication, aerospace, etc. PICs will be crucial to realize high-performance and low-power requirements for emerging high performance computing applications, such as Big Data analytics, image- and signal-processing, etc. PI Nikdast has recently developed an experimental course (ECE580B6) for *CSU students* to provide hands-on experience on silicon photonics for our students as well as enable them develop high-performance silicon photonics chips for real world applications (e.g. chip-level communication and switching devices, bio-sensors for early disease diagnosis). This course is open to *students from different departments* at CSU. In addition, students will have direct contact with industry (HPE Labs.) for the projects in this course.

To support *CSU students* who working on silicon photonics, we need to possess a means to test and characterize the chips that are designed in both the experimental course and research labs working in this area. We require *fast, accurate, and extensive* characterization of hundreds and thousands of silicon photonic devices on different chips and even wafers. Such extreme characterizations are impossible through conventional non-automated test platforms, in which a person should calibrate the testing equipment (e.g., optical fiber array coupled to a PIC) for each single device to perform just a single test. In addition, one needs to make sure that a device characterization is free from human errors. Addressing such problems, there is a need for an automated probe station capable of characterizing many silicon photonic devices with high accuracy and in a timely manner. Therefore, we seek ESTC support for purchasing an automated probe station for testing PICs for *CSU students*. This equipment will complement fabrications of PICs that will be performed at *AIM Photonics*, in which CSU has recently become an academic member and PI Nikdast is the CSU representative. This is a unique opportunity for CSU students, as they will have access to a state-of-the-art testing facility.

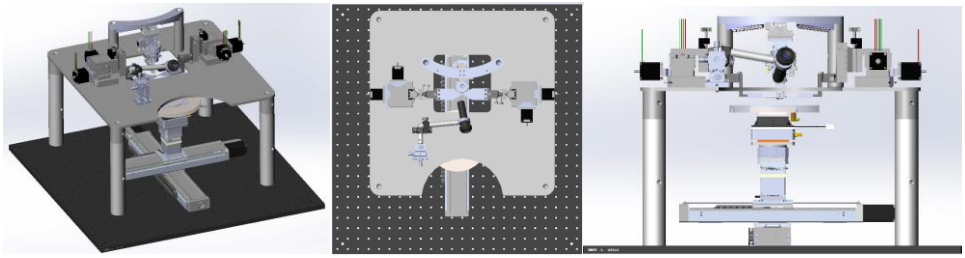

Fig. 1: CAD representation of the multidie/wafer platform automated probe station for efficient silicon photonic IC characterization (MAPLE LEAF PHOTONICS CONFIDENTIAL ©).

Automated Probe Station Testing Equipment

Along with recent advances in silicon photonics, there has been some progress in testing facilities. Fig. 1 indicates an automated probe station testing equipment. The automated station has been designed and patented by Maple Leaf Photonics Inc. In general, the automated station includes an advanced camera, moving chip stations, a fiber array, a thermal stabilizer, and several mechanical arms that automatically move and detect devices on the chip/wafer located on the chip station. The probe station automatically calibrates the laser light coupling to the grating couplers on the chip, maximizing the testing efficiency. It can be controlled by a software and is capable of efficiently testing many devices automatically. PI Nikdast has experience working with this equipment.

Benefits to CSU and College of Engineering Students

Silicon photonics and integrated photonics is a promising technology forming the future of high performance computing (HPC), communications, sensing, bio-sensing, aerospace, and many other domains. The equipment will give colleagues and students in the Engineering College (with focus on lasers and optics, optoelectronics, and HPC integrating silicon photonics) access to a state-of-the-art testing facility. Moreover, graduate students will be trained to use this equipment, providing them with a unique experience of using a state-of-the-art testing facility, required in leading companies progressively investing and researching in this field (IBM, HPE, Intel, etc.) The training will be part of the new graduate-level course in the ECE department, Silicon Photonics for Computing Systems, developed by PI Nikdast. Lastly, access to such equipment will create many collaboration opportunities between the ECE department at CSU and other departments at CSU and in other universities as well as industry that need access to such facility for testing purposes.