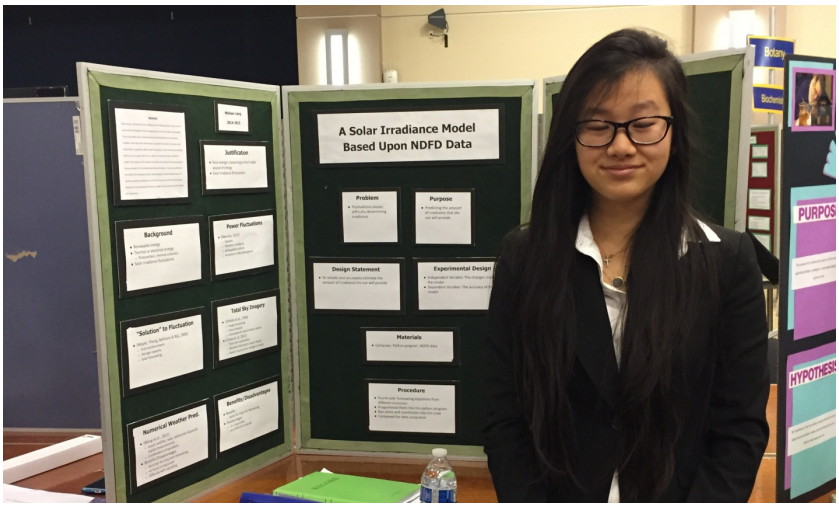
Summer 2014 UT RISE interns' research in renewable energy leads to honors and awards

During the summer of 2014, the University of Toledo continued to provide summer internships to high school students through the Research In Science & Engineering (RISE) Program. The 2014 RISE class consisted of five students: Donovan DeMilt from Ottawa Hills High School; Alan Fong, Melissa Liang, and Allison Clausius from Sylvania Southview High School; and Richard Jin from Maumee Valley Country Day School. Their projects covered a wide range of topics pertaining to renewable energy science and technology. Each student was paired with a faculty mentor and a more junior mentor (e.g. a postdoctoral associate, a graduate student, or an undergraduate student). Each high school researcher became part of a larger team for eight weeks while working on an individualized project. The students received stipends provided by a combination of NSF funding and funds from endowments associated with the Wright Center Endowed Chair for Photovoltaics (Prof. Heben) and the Ohio Research Scholar Endowed Chair (Prof. Yan). Four out of five students presented their work in various science fairs. Two out of four of Ohio's delegates to the Intel International Science and Engineering Fair (ISEF) came from our RISE program. The Intel ISEF is the largest and most prestigious pre-college science competition in the world.



Accomplishments of note from the RISE class of 2104 include the work of Melissa Liang (pictured below), who participated in the Buckeye Science and Engineering Fair (BSEF) in Columbus, Ohio. She scored a perfect 40/40 for her work on modeling cloud coverage and movement and the impact of solar irradiance. For this work, Melissa implemented the Atwater clear sky model along with Atmosphere Chemistry and Physics cloud transmittance models. She and her mentors created an algorithm that could calculate the irradiance and allow comparison to the measured value. Melissa found that the model worked best on clear sky days with error less than 6%, but on cloudy days the error increased to 25%.

Richard Jin also scored a perfect 40/40 at the BSEF and was selected to be one of the top four to advance to the Intel ISEF. Richard investigated the sulfurization of copper antimony sulfide thin films used in photovoltaic applications. To do this, Richard placed a sputtered copper antimony sulfide thin film in a sulfurization furnace at various temperatures to crystallize the thin films. XRD of the thin films after sulfurization showed that treatment at temperatures under 340 °C resulted in a predominantly Cu_3SbS_4 crystal structure, while sulfurization above 340 °C exhibited a mixed phase crystal structure of $CuSbS_2$ and Sb_2S_3. The amorphous and sulfurized films had band gaps of 2.0 and 1.5 eV, respectively, and exhibited high optical absorption. Sulfurization increased carrier density and reduced the band gap.

The best single cell power conversion efficiency of 0.66% was obtained with a sulfurization temperature of 310 °C.

Alan Fong performed research on the properties of sputtered thin films and studied how the properties of the films were affected by the state and age of the sputtering target. He participated in the District Science Day at the University of Toledo and received a Superior Rating and perfect score. He received the Governor's Thomas Edison Award (first place) for Excellence in Student Research in the Advanced and Alternative Energy category, and qualified for BSEF and the State Science Day at Ohio State University. At State Science Day he received a Superior Rating (39.5/40), and won the Governor's Award for Excellence in Environmental Protection Research and a Stone Laboratory Scholarship.

Allison Clausius (pictured at right) also scored a perfect 40/40 at BSEF and also advanced to the Intel ISEF. Alison was also a RISE Intern in 2013. For her 2014 RISE Project she combined her interests in fashion, technology, and photovoltaics to create a photovoltaic dress that can power portable electronics. Working with her mentors at the Wright Center for Photovoltaics Innovation and Commercialization, Allison selected the appropriate solar cells, designed and built the needed electronic circuitry, and fabricated the solar cells into a high fashion, wearable dress. Her combination of technology and fashion has attracted tremendous interest from both the fashion and solar cell technology communities. Allison has worn her dress in several fashion and technology shows, and her work has been the subject of many news and internet blog stories. A particularly good story on her work was presented by the Society for Science and the Public. (https://student.societyforscience.org/blog/eureka-lab/%E2%80%9Csun%E2%80%9D-dress-mixes-fashion-and-science)