

REU student roster at UNLV Summer 2011

Student	Home Institution *	Faculty Mentor	year in school **
Carryer, Justine	Colorado College (B)	Ravhi Kumar	Sophomore
Guerrero, Quinton	Monmouth College (B)	Pamela Burnley	Junior
Jeffries, April	SUNY Albany (D)	Andrew Cornelius	Junior
Lotshaw, Phil	Willamette University (B)	David Shelton	Junior
Macholl, Nicholas	Loyola Chicago (B)	John Farley	Junior
Monello, Julius	Reed College (B)	Oliver Tschauner	Sophomore
Mosher, Tyler	Clarkson University (D)	John Farley	Junior
Smith, Anna	Davidson College (B)	David Shelton	Junior
Stewart, Brandon	College of Southern Nevada (B)	Ravhi Kumar	Sophomore

*highest degree conferred in physics

** year in school completed by May 2011

Justine Carryer (Colorado College) worked with Prof. Ravhi Kumar (Physics). She studied barium carbonate (BaCO_3) under high pressure (up to 20 GPa, or 200,000 atmospheres). She performed powder X-ray diffraction experiments on the sample using the synchrotron X-rays at UNLV's beamline at the Advanced Photon Source at Argonne National Laboratory. She measured the lattice constants, and observed a first-order phase transition under pressures of 4-8 GPa. She obtained the equation of state for BaCO_3 .

Quinton Guerrero (Monmouth College) worked with Prof. Pamela Burnley (Geosciences). She analyzed rock samples: deformed mantle xenolith from the Jaegersfontein mine in South Africa. The sample analysis consisted of polishing, then oxidizing the samples, and observing the surface by Scanning Electron Microscope (SEM) in order to measure the dislocation density. The orientation of the grains were analyzed by Electron Backscatter Diffraction (EBSD). The main result was the observation of a correlation between dislocation density and orientation of the grains.

April Jeffries (SUNY Albany) worked with Prof. Andrew Cornelius (Physics). She studied the behavior of cobalt copper oxide (CoCu_2O_3) at high temperatures. This compound is an example of a spin-ladder compound, of interest because of its relationship with high-temperature superconductivity. Samples were studied by powder X-ray diffraction as a function of temperature up to 1000 C. The lattice parameters were extracted as a function of temperature. Analysis revealed the coefficient of thermal expansion of cobalt copper oxide.

Phil Lotshaw (Willamette University) and **Anna Smith** (Davidson College) worked with Prof. David Shelton (Physics), performing measurements of nonlinear optical properties of materials. The students measured the second hyperpolarizability of carbon tetrachloride gas. While the second hyperpolarizability can be calculated and measured for a simple system like helium, more complicated cases like carbon tetrachloride are currently a challenge for theory. Making high-quality measurements can assist the development of more sophisticated theoretical treatments.

Nicholar Macholl (Loyola Chicago) and **Tyler Mosher** (Clarkson University) worked with Prof. John Farley (Physics). They synthesized a series of mixed spinel oxides, such as $Mg_xCr_{(1-x)}Cr_2O_4$, magnesium zinc chromate, where x varies from 0 to 1. They obtained Raman spectra from these compounds using a micro-Raman laser spectrometer. The Raman peaks were followed as a function of elemental composition. The careful study of the dependence of the Raman spectra on composition can help in assigning the Raman peaks to particular molecular vibrations.

Julius Monello (Reed College) worked with Prof. Oliver Tschauner (Geosciences) and Dr. Valentin Iota (Physics). Monello investigated the suitability of alkali halide alkanolates as a pressure medium in a high-pressure diamond anvil cell. Conventionally a mixture of methanol and water is used as a pressure medium. But careful optical measurements by Monello, using a triple monochromator, demonstrated that in some high pressure ranges, alkali halide alkanolate is a more hydrostatic medium than the conventional methanol/water mixture.

Brandon Stewart (College of Southern Nevada) worked with Prof. Ravhi Kumar (Physics). Stewart studied a refractory metal silicide, Nb_5Si_3 , under high pressure. Powder X-ray diffraction studies were performed using synchrotron X-ray radiation at the Advanced Light Source at Argonne National Laboratory. The pressure range went up to 35 GPa. A pressure-induced phase transition was induced at 10 GPa. While refractory metal compounds have been studied as high-temperature materials, this is the first high-quality measurement of the high pressure behavior of this compound.