Trends in Photoemission at the ALS

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Angle resolved photoemission spectroscopy (ARPES) of valence bands is a superb, if not superior, tool for probing occupied electronic states. In principle it accesses not only single-particle bandstructures but also details of many-body interactions and correlation in materials. With modern synchrotron sources, it is feasible to collect a complete high resolution data set (energy and momentum dependence in the 3 dimensional Brillouin zone) in a day, and for quasi 1- and 2-dimensional materials, in under an hour. This has led to a revolution in not only the quality but also the quantity of data which can be routinely collected. We can now traverse (or lose ourselves in) a multidimensional space spanning not only E and $\mathbf{k}$, but also temperature, polarization (photon and spin), magnetization, sample composition, etc. We are now challenged to systematically and efficiently apply ARPES to an ever-expanding range of engineered nanostructured materials.

To that end, we built the Electronic Structure Factory (ESF) endstation at beamline 7.0 of the Advanced Light Source. Optimized for fast, high precision ARPES of valence bands of *in situ* grown materials, it employs a precision 6-axis goniometer which covers temperatures from 16 to 2500K, and features a molecular beam epitaxy chamber for sophisticated *in situ* sample preparation. It is connected to a high speed workstation for on-line visualization and manipulation of the data — it is no small challenge to analyze the data at a rate comparable to its acquisition!

Results will be presented on a variety of systems from 1 to 3 dimensions obtained at the ESF endstation. Three dimensional subsets of higher dimensional data will be presented as animations in some cases. In addition, I will discuss future trends at the ALS, in the direction of more sophisticated sample preparation and smaller photon spot size.