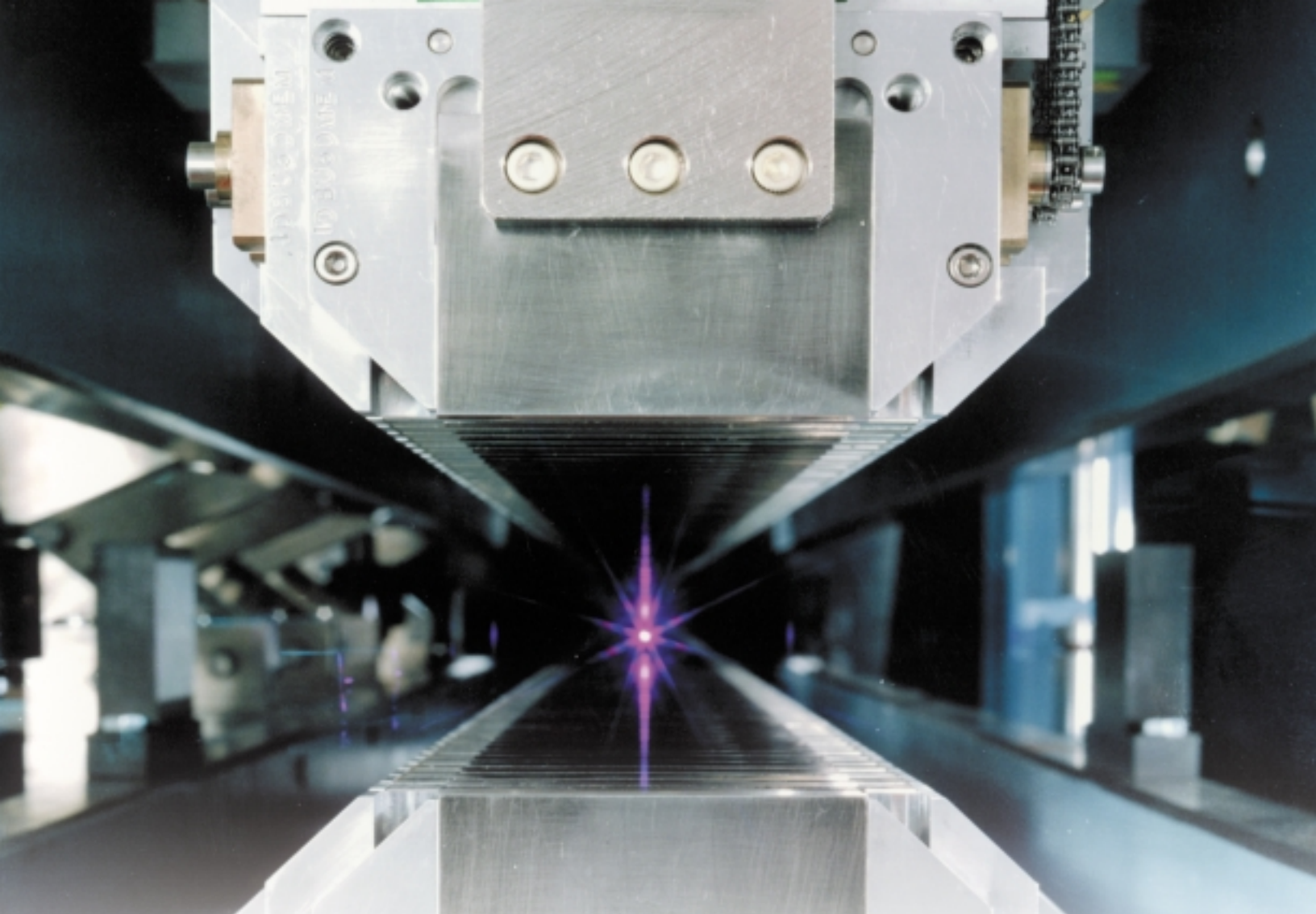

Actinide Photoemission Measurements at the Advanced Light Source

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The Advanced Light Source (ALS) at the Lawrence Berkeley National Laboratory is the nation's premier third-generation synchrotron light source for performing vacuum ultraviolet (VUV) and soft x-ray studies of materials. We have used Beamline 7.0.1 at the ALS to perform photoemission spectroscopy (PES) measurements of plutonium metal and compounds. The beamline operates over the energy range 80–1200 electron-volts (eV) using an undulator (shown in the top photo) with a 5-centimeter period and a spherical-grating monochromator. Spectral resolutions of up to 8000 ($E/\Delta E$) can be achieved with a light flux (per 0.01 percent bandwidth) of approximately 10^{13} photons per second (photons/s) for energies less than 200 eV, 10^{12} photons/s for intermediate energies, and 10^{11} photons/s for energies greater than 500 eV. Shown in Figure 1 is a schematic of the beamline from the undulator insertion device in the synchrotron ring to the end stations (or analysis chambers), where the light is used for materials and surface measurements. To select the photon energy, we use one of three gratings. The adjustable beam-defining apertures and the refocusing mirrors set the size of the photon spot at the sample surface.

The UltraESCA photoemission analysis chamber was built around a 137-millimeter spherical-capacitor electron-energy analyzer (Physical Electronics Omni IV), which allows high-resolution photoemission measurements, as well as photoelectron imaging through adjustment of the input lenses. The schematic in Figure 2 shows the location of the UltraESCA analysis chamber on the beamline, past the last refocusing mirror, relative to the other instruments on the beamline. This location takes advantage of the small focus of the photon beam, which may be as small as 50 micrometers in diameter at