Although unique potentials of terahertz waves for chemical identification, material characterization, biological sensing, and medical imaging have been recognized for quite a while, the relatively poor performance, higher costs, and bulky nature of current terahertz systems continue to impede their deployment in field settings. In this talk, I will describe some of our recent results on developing new terahertz electronic/optoelectronic components and imaging/spectrometry architectures to mitigate performance limitations of existing terahertz systems. In specific, I will introduce new designs of high-performance photoconductive terahertz sources that utilize plasmonic nanoantennas to offer record-high optical-to-terahertz conversion efficiencies – demonstrating more than three orders of magnitude increase compared to the state of the art. I will describe that the unique capabilities of these plasmonic nanoantennas can be further extended to develop terahertz detectors and heterodyne spectrometers with quantum-level detection sensitivities over a broad terahertz bandwidth at room temperatures, which has not been possible through existing technologies. I will also present a terahertz time-domain imaging system based on a plasmonic photoconductive terahertz focal-plane array, which provides ultrafast-time-resolved and frequency-resolved amplitude and phase information of the imaged object with an imaging speed that exceeds 16 fps. The rich information provided by the terahertz focal-plane array allows super-resolving both shape and depth information of imaged objects with a lateral/depth resolution as small as 60/10 μm and an effective number of pixels exceeding 1-kilo-pixels. These plasmonic antennas and device architectures are optimized for operation at telecommunication wavelengths, where very high power, narrow linewidth, wavelength tunable, compact and cost-effective optical sources are commercially available. Therefore, our results pave the way to compact and low-cost terahertz sources, detectors, spectrometers, and imaging systems that could offer numerous opportunities for e.g., medical imaging and diagnostics, atmospheric sensing, pharmaceutical quality control, and security screening systems.