

Smarter than an iPhone: The Emergence of the Modern Microscope

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Much like mobile phones, microscopes in general and electron microscopes in particular have made great strides in sophistication, power and user-friendliness. The underlying technology is the modern microprocessor, which has automated the mundane, and made the sophisticated readily accessible. The progress has happened on many fronts:

- Microscope optics, which can include several hundred independently adjustable optical elements, in order to resolve $<0.5 \text{ \AA}$ and $<10 \text{ meV}$
- Autotuning algorithms, which are able to adjust tens of independent optical parameters in quasi-real-time, and make the instrument user-friendly despite all the optical elements “under the hood”
- Detectors, which are getting close to the ultimate: capturing the X, Y, t (time) and E (energy) signature of every arriving electron
- Analysis software, which is able to separate weak signals from noise and discern subtle data patterns in data sets amounting to many Gigabytes.

This talk will review the progress made, and provide practical examples of new capabilities.