The *apyron* – new ways of automation in Raman imaging

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In the past decade confocal Raman imaging gained in importance in the characterization of heterogeneous materials and is applied in almost all fields of research. The power of Raman spectroscopy stems from its unique capability to identify molecules and how atoms are bound to each other. In graphene research it could be shown, that Raman spectra are sensitive to: the number of layers forming the graphene sheet (*1*), the influence of the substrate on the properties of graphene (*2*), and the atomic structure of the edges of graphene (*3*). Furthermore, the stacking of graphene layers was studied by analyzing the second order overtone combination Raman modes, demonstrating the unique potential of Raman scattering for probing the graphene electronic band structure, the phonon energy dispersion, and the electron-phonon interaction in a few layer graphene as a function of layers number and stacking order (*4, 5*). Due to the unique properties of graphene, the field of its applications is immense, not only for the design of new electronic devices, but also for energy storage (*6, 7*), gas sensors (*8*), development and fabrication of super nylon composites (*9*), and new materials for medical devices (*10, 11*) – to mention just a few recent publications from these fields of applications.

As Raman imaging is becoming more and more a routine measuring technique for the characterization of i.e. new graphene-based materials and devices, the demand for instrumentation with automated measuring routines is indispensable. The newly developed *apyron* confocal Raman microscope (Fig. 1 left) is designed for ease of use without compromising confocality, lateral and spectral resolution, and speed of acquisition of large spectral data sets. Change of laser wavelength upon a mouse click and absolute laser power control to 0.1 mW accuracy are implemented in an intuitive user interface. A computer controlled change of wavelength-optimized spectrographs, each equipped with three gratings is also integrated in the *apyron*. Furthermore, this new automated design of a confocal Raman microscope can be merged with a Scanning Electron Microscope resulting in the RISE microscope (Fig. 1 right).

The aim of this presentation is to highlight the new features of the *apyron* confocal Raman microscope and its potential for applications in the field of graphene research.

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Figure 1: *apyron* confocal Raman microscope (left) and RISE microscope (right).