NanoARPES investigation of pristine graphene: evidencing the need for high spatial resolution in ARPES experiments

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Abstract
Angle-resolved photoemission spectroscopy (ARPES) is the most direct tool to measure the electronic structure of materials. In particular, fine features of the spectra can be analyzed for evaluating the electron self-energy. Owing to a setup allowing ARPES investigation with submicron resolution and state-of-the-art energy and momentum resolution operated at the Antares beamline of the Soleil synchrotron [1], we show here first that ARPES spectra of pristine and virtually undoped monolayer graphene acquired on a small spot do not display manifestations of self-energy. We next demonstrate that, although the region of the sample investigated is a unique graphene domain, it displays faint spatial inhomogeneity, both in its crystallographic orientation and its thickness, which is undetectable with conventional ARPES but renders the spectra improper for self-energy extraction. These results indicate that care should be taken when analyzing ARPES spectra obtained with poor spatial resolution.
A nanoARPES image of the graphene domain investigated is shown on Fig. 1, together with spectra acquired at different spots along the x-axis on the image. Differences between spectra are evident.
The results presented here are detailed in ref. [2].

References

[1] J. Avila & M. C. Asensio, Synchrotron Radiat. News **27**, 24 (2014)
[2] F. Joucken *et al*., Phys. Rev. B **93**, 241101(R) (2016)

Figure

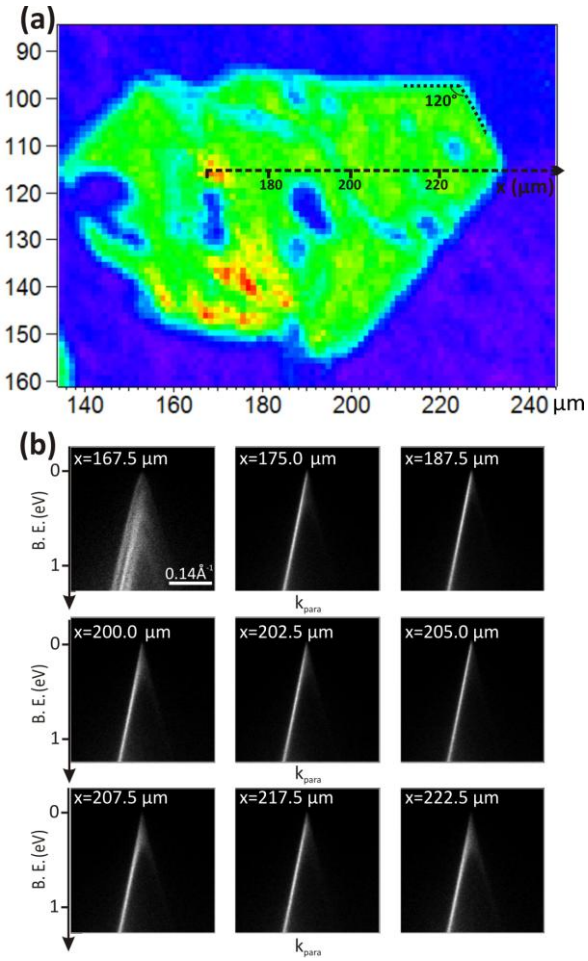

Figure 1: A nanoARPES image of the graphene domain investigated (a), together with spectra acquired at different spots along the x-axis on the image (b).