Superconductivity in cuprates is the result of two parts, the superconductivity of the single CuO$_2$-plane plus that of a stacked multi-CuO$_2$-layer system. Possibly the whole (multi-layer superconductivity) is more than the sum of the parts (single-layer superconductivity). But, without doubt, the properties of the single CuO$_2$-plane have to be understood before making the systems more complex and to access at universal properties.

From the experimental point of view, the almost undisturbed single CuO$_2$-plane can be studied in the single-layer cuprates, like e.g. Bi$_2$Sr$_2$-La$_x$CuO$_{6+\delta}$ (Bi-2201) with one CuO$_2$-plane per crystal unit cell. From these superconductors we have grown high-quality single crystals and the hole concentration in the CuO$_2$-plane can be varied continuously from the overdoped
to the optimally-doped regime down to underdoped. Latterly we adopted also a more gentle doping technique by adding some lead, i.e. \((\text{BiPb})_2\text{Sr}_{2-x}\text{La}_x\text{CuO}_{6+\delta}\). All samples were characterized with regard to its chemical composition (EDX, iodometric titration) and structural properties (Laue diffraction, LEED), and by magnetic susceptibility, electrical transport and x-ray absorption spectroscopy (XAS). In the present contribution we address at the electronic structure of the CuO$_2$-plane of the optimally doped and weakly overdoped regime of the phase diagram.

The \(k\)-resolved spectral weight at the Fermi level has been investigated by high-resolution photoemission using the Scienta SES-200 at the U-PGM and U-NIM beamline. Previous polarization dependent photoemission revealed intensity variations and an unexpected band splitting at the M(\(\pi\),0)-point of the Brillouin zone which were not explainable by dipole selection rules \cite{ref1}. With the excellent experimental conditions at the SRC we were able to observe this splitting directly along the \(\Gamma M\) direction (see Fig. 1). This and all additional experiments support a one-dimensionality of the electronic structure along \(\Gamma M\), the direction of the copper-oxygen bonds, with separation of the spin and charge degrees of freedom:

(i) The two branches reveal different dispersion and thus different velocities.
(ii) Aside from \(\Gamma M\) one observes no splitting and with respect to the perpendicular \(\Gamma M\) directions a distinct asymmetry is observed.
(iii) Perpendicular to \(\Gamma M\) the split excitations merge on the Fermi surface.
(iv) The temperature dependence of the splitting reveals two observations, that it makes no distinct effect when crossing \(T_c\) and that it vanishes at higher temperatures in a small temperature range, between 95K and 125K for optimal doping and at about 75K for slightly overdoped samples.
(v) The splitting survives in weakly overdoped samples and vanishes for stronger overdoped ones.

All aspects of the experimental observations of the CuO$_2$-plane can be understood within the framework of a strongly correlated electron system. Microscopically the antiferromagnetic order of the charge-transfer insulator survives with doping, at least locally, leading to charge separation and formation of the so-called stripes. Due to neutron scattering and scanning tunneling microscopy the stripes are aligned along the \(\Gamma M\) direction where we observe the one-dimensionality in the electronic structure of the CuO$_2$-plane. In this respect the split spectral weight at \(E_F\) along \(\Gamma M\) could be explained by spinon-holon excitations like in a 1D Tomanaga-Luttinger model (see Fig. 1). Then the unusual polarization behavior observed in Ref. \cite{ref1} which could not be explained by dipole selection rules can be easily understood if the spin direction is 45\(^\circ\) off the direction of the stripes.
