ESRF	**Experiment title:** Macroscopic phase separation in Mg1-xAlxB2 near x=0.5	**Experiment number**: HS-2953
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Names and affiliations of applicants (* indicates experimentalists):

Laura SIMONELLI*, Matteo FILIPPI, Michela FRATINI*, Valerio PALMISANO*, Naurang L. SAINI

Unità INFM and Dipartimento di Fisica, Università La Sapienza, Piazzale Aldo Moro 2, 00185, Roma (Italy)

Report:

This experiment was aimed to characterize the nature of the superstructure ordering in the $Mg_{0.5}Al_{0.5}B_2$ using single crystal diffraction to explore the macroscopic phase separation in $Mg_{1-x}Al_xB_2$ and to find a possible correlation between the superconductivity and phase separations in the proposed system.

During the allocated beam-time we have measured high resolution single crystal x-ray diffraction on the $Mg_{0.5}Al_{0.5}B_2$ single crystals. The measurements were performed on high quality single crystals of $Mg_{0.5}Al_{0.5}B_2$ prepared by high-pressure cubic anvil technique with X-ray photons wavelength λ=0.95 Å. The samples are well characterized stochiometrically and studied for their superconducting properties prior to the beamtime. The choice of this sample with x=0.5 was due to the fact that electron diffraction, transmission electron microscopy and high resolution synchrotron X-ray powder diffraction have indicated existence of a superstructure. The superstructure appears to arise from the ordering of Al and Mg in subsequent layers which results in the doubling of the c-axis. However electron

diffraction and high resolution electron microscopy studies indicated that the superlattice in $Mg_{0.5}Al_{0.5}B_2$ has components both along c and in the hexagonal basal plane.

In the measurements our focus was to get independently information on the in plane and out of plane components of superstructure. Our measurements indeed show that the structural modulation have both in-plane and out of plane components (Figure 1). Effectively, the superstructure appears to arises from the ordering of Al and Mg in subsequent layers which results in the doubling of the c-axis. The structural modulation of the basic MgB_2 structure which doubles the simple c axis contains a significant component in the hexagonal a-b plane that have a elliptical symmetry. The results are to being analyzed to enlighten the nature of the superstructure modulation.

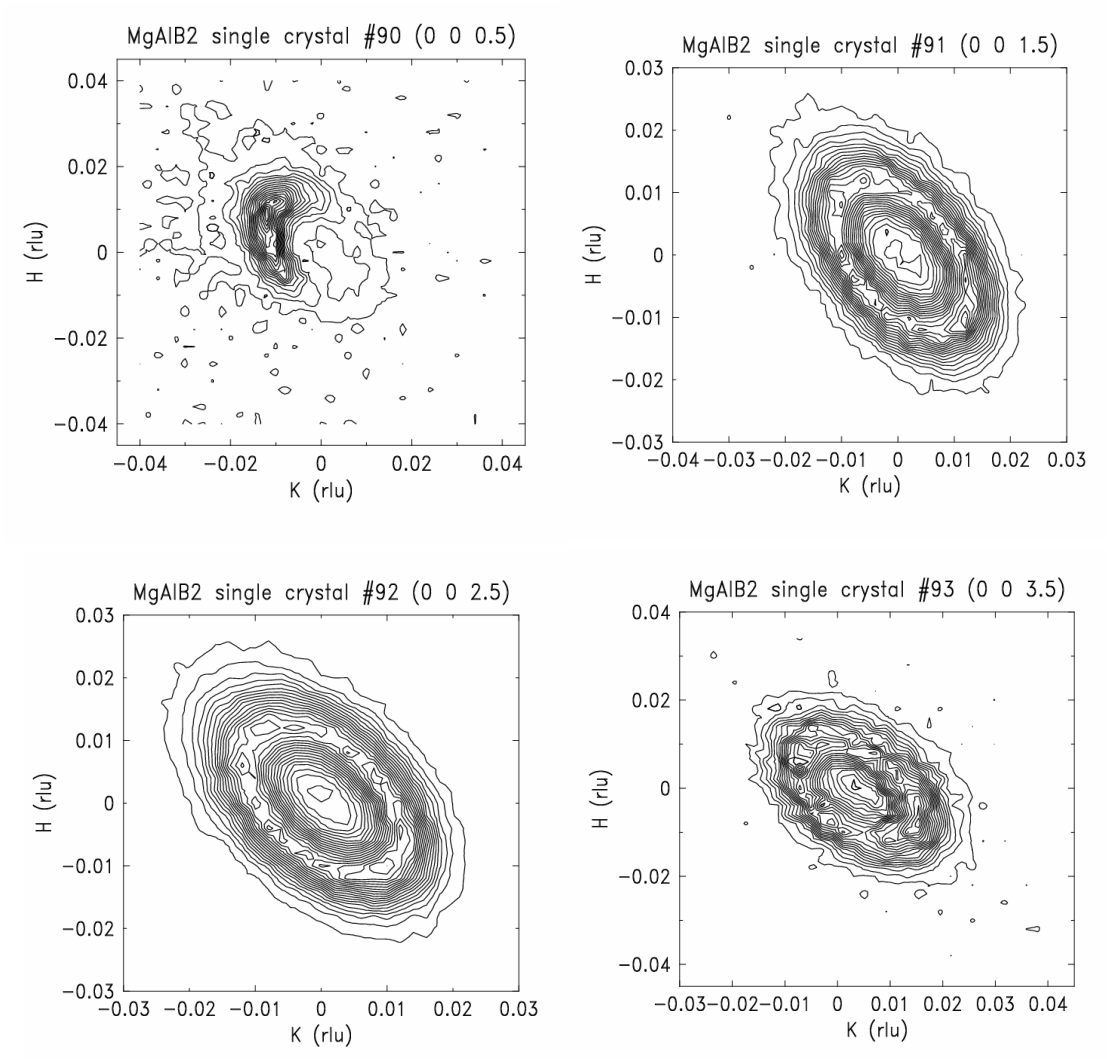

Figure 1: mapping in the hk plane at l = 0.5, 1.5, 2.5 and 3.5 measured at room temperature.