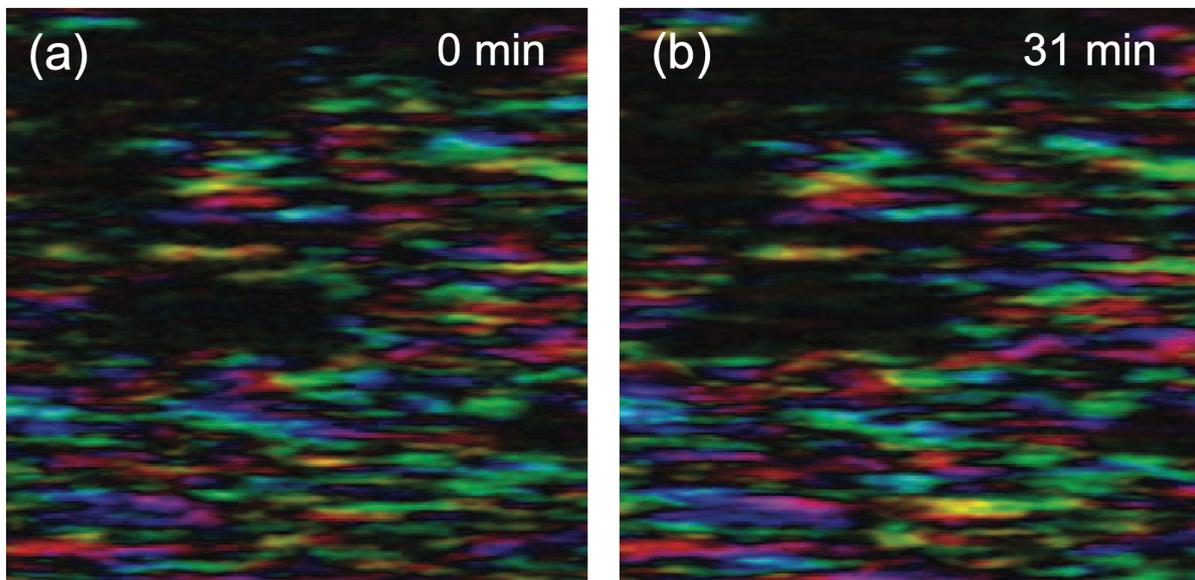


## Phase Domain imaging by Bragg Ptychography

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Ptychography is an inherently phase-sensitive technique obtaining images by inverting diffraction from a structured probe in the Bragg condition on a crystalline sample. It is found that inversion using the ePIE or similar algorithms yields better quality phase than amplitude information. This can be used to provide accurate sample density information in the tomo-ptycho combination, suitable for material segmentation, for example. Bragg Ptychography offers a unique opportunity to identify phase shifted structural domains in thin film samples. These are expected during epitaxy because of coalescence of the film from multiple nucleation sites on the substrate. They are also expected for charge and magnetically ordered domains with limited spatial extent given by their correlation lengths. These may be pinned at defect sites or randomly located within the crystalline sample and may fluctuate under thermal excitation. Here we present phase domain images, shown in the figure, obtained by Bragg Ptychography in the doped 214 nickelate,  $\text{La}_{1.775}\text{Sr}_{0.225}\text{NiO}_{4.07}$ , measured at  $(0.36\ 0.36\ 0)$  used to probe spin-ordering, and a partial understanding of their fluctuations [1]. We also present examples of the application to epitaxial thin films.



[1] Real Space imaging of Spin Stripe Domain Fluctuations in a Complex Oxide, Longlong Wu, Yao Shen, Andi M. Barbour, Wei Wang, Dharmalingam Prabhakaran, Andrew T. Boothroyd, Claudio Mazzoli, John M. Tranquada, Mark P. M. Dean and Ian K. Robinson, Physical Review Letters 127 275301 (2021)