

Marc-Henri Julien

Title: NMR insights into charge order in the cuprates

Abstract: Direct evidence of charge order in the cuprates dates back to the discovery of stripe ordering by Tranquada and coworkers in 1995 (1). Since then, other hints of charge order have fueled the debate, particularly density-of-states modulations seen by scanning tunneling microscopy. However, the long-range order of the stripe materials has long remained an epiphenomenon and, to many of those obsessed with finding the mechanism of superconductivity, a purported red herring. In the absence of new experimental facts, especially in a clean cuprate such as YBCO, exchanges between “prostripes” and “stripe-skeptics” were for many years, to say the least, contentious...

Things started to change in 2011 with the discovery of charge order in YBCO, using NMR and high magnetic fields (2): superconductivity was found to compete, and to coexist, with a clean, long-range, form of charge-density-wave (CDW) order. We argued that this result strongly supported the idea that underdoped cuprates are generically unstable towards CDW formation. This affirmation is now unanimously accepted, owing to the tsunami of X-ray scattering studies in the following years (3).

In this presentation, I shall use our NMR results in YBCO (2,4-9) to illustrate why NMR is a powerful probe of charge order, why high magnetic fields prove particularly useful and why CDW order may be an important piece of the high- T_c puzzle. Some of the open questions will be underlined (10).