Visualization of a stable intermediate phase in photoinduced metal-to-insulator transition in manganites

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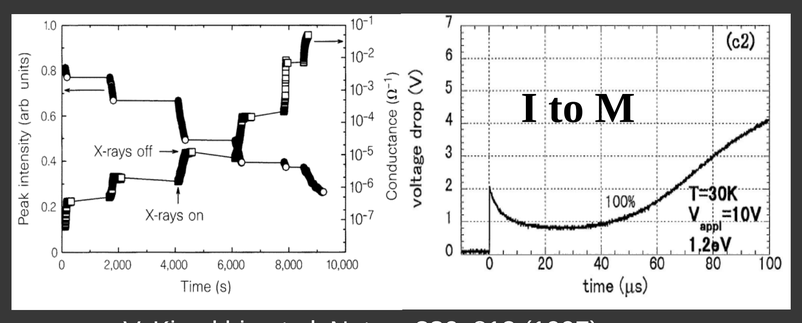
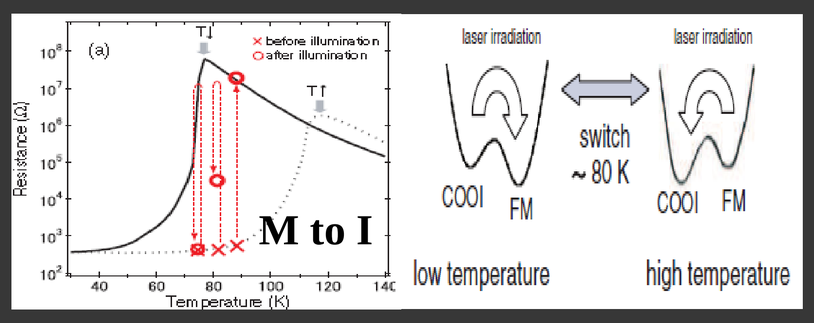
Introduction

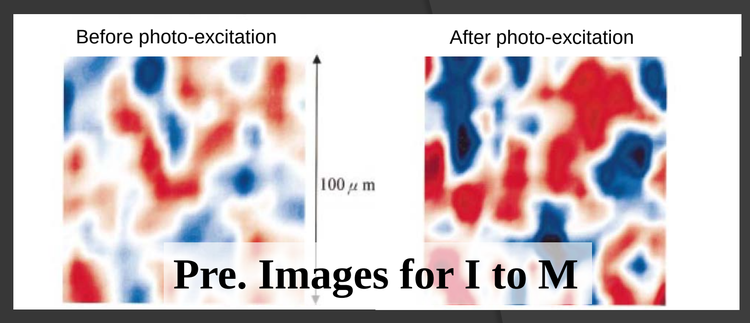


V. Kiryukhin et al. Nature **386**, 813 (1997).

K. Miyano et al. Phys. Rev. Lett. **78,** 4257 (1997).



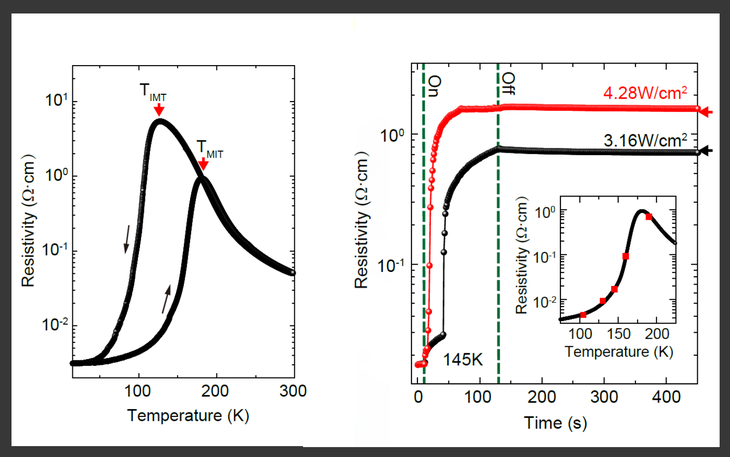
N. Takubo et al. Phys. Rev. Lett. **101**, 177403 (2008).



Y. Okimoto et al. Appl. Phys. Lett. **80**, 1031 (2002).

Results

I. Transport Properties



Sample :

40 nm $La_{0.325}Pr_{0.3}Ca_{0.375}MnO_3$ on LAO(001)

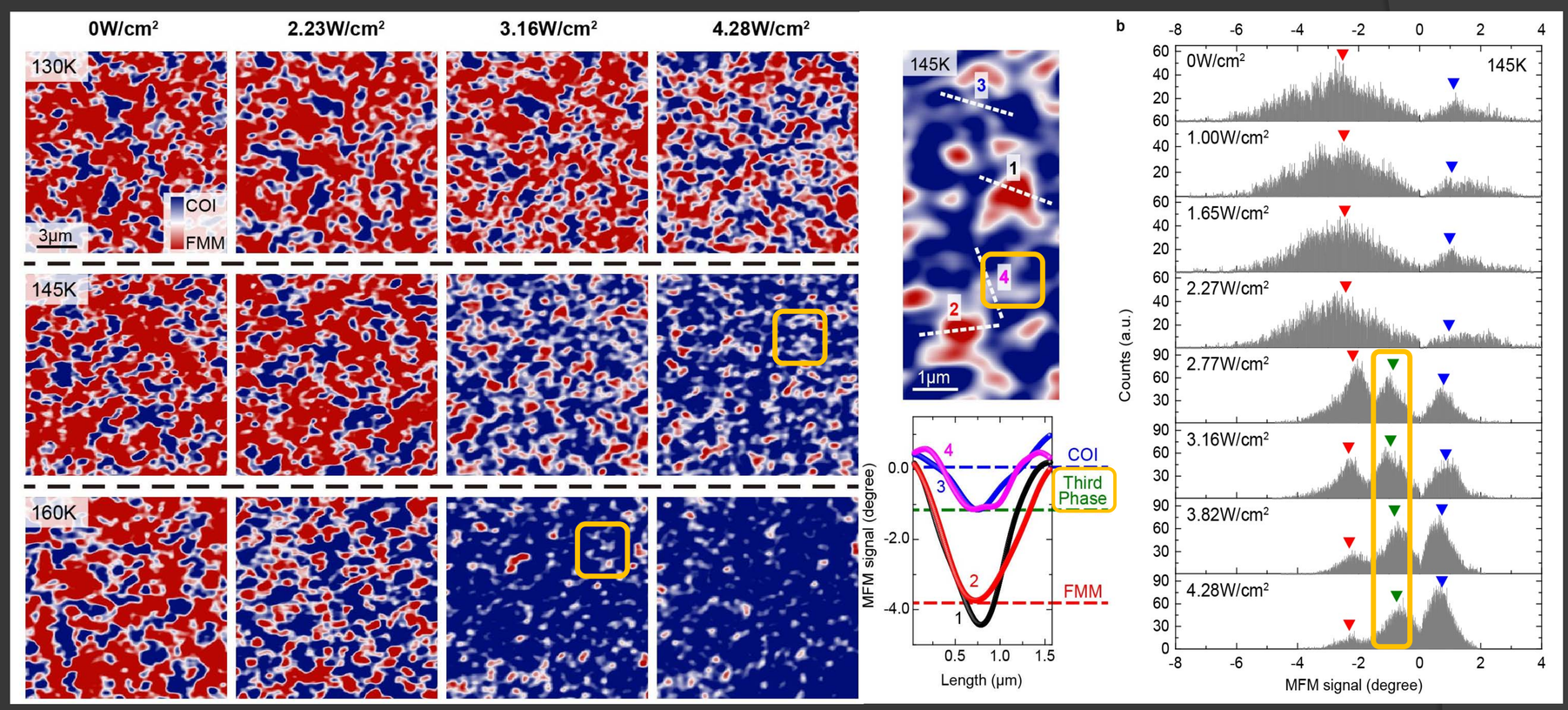
Laser :

1.3 ns 2 kHz 532 nm

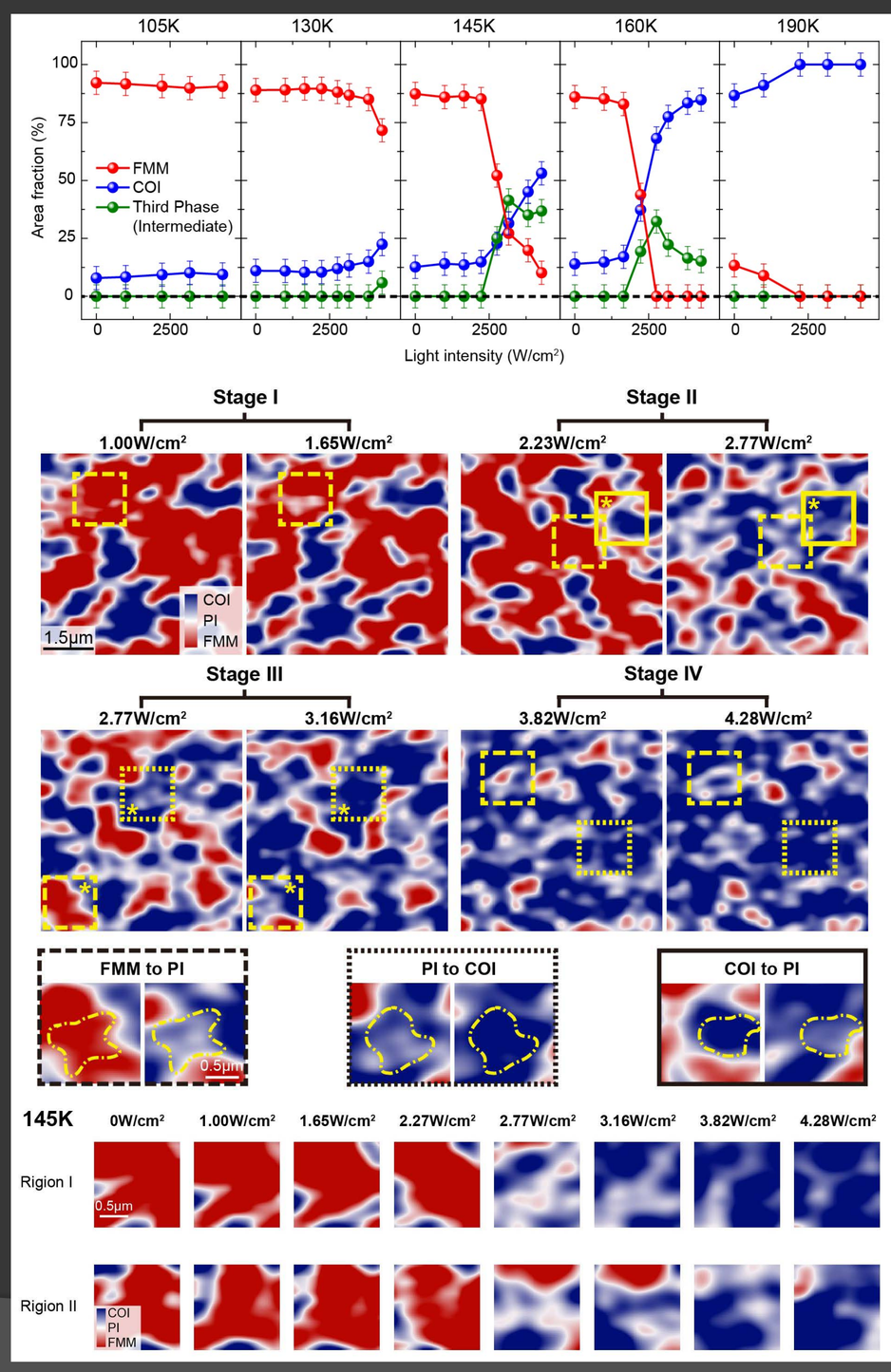
MFM:

Atto Cube commercial set-up

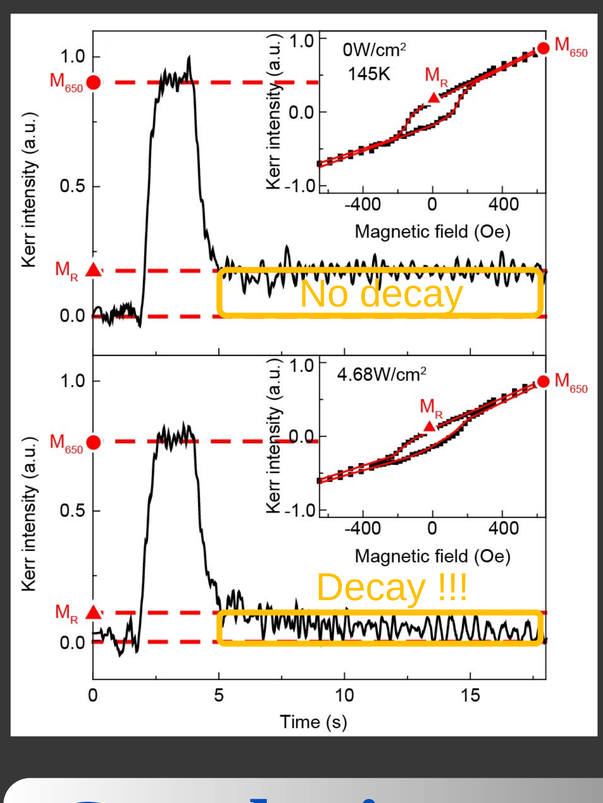
II. MFM images (The COI phase increases as well as the *"white" phase* !)



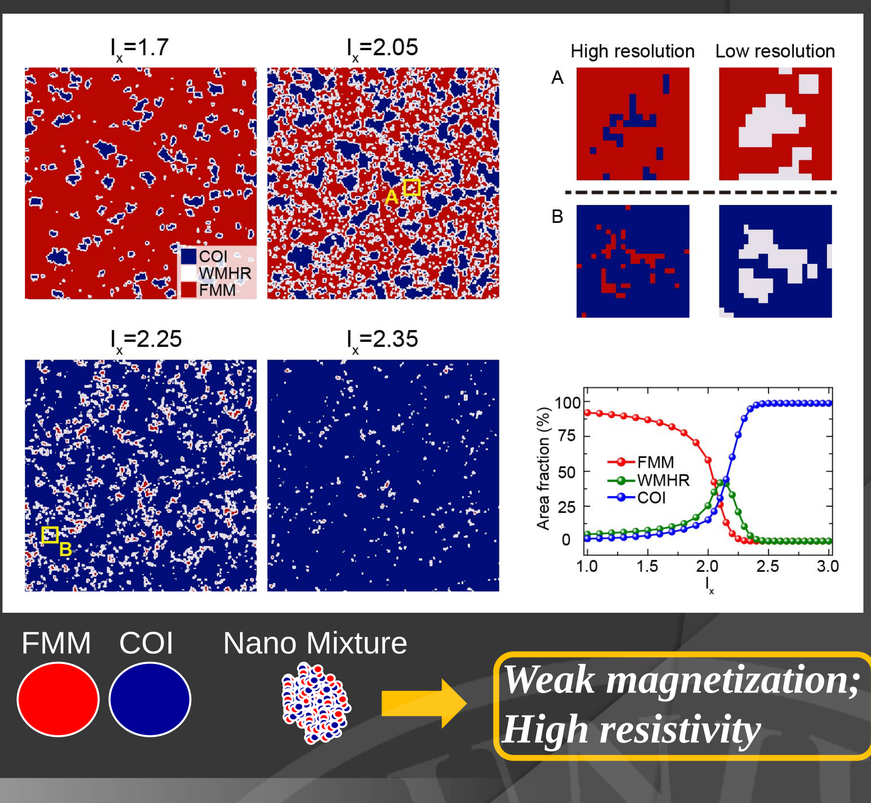
III. The mediatory role of the third (intermediate) phase



IV. The nanoscale mixing nature of the third phase (MOKE)



V. The nanoscale mixing nature of the third phase (Numerical calculation)



FMM COI Nano Mixture → ***Weak magnetization; High resistivity***

Conclusion

- A stable intermediate phase **emerges and mediate** photo-induced IMT in manganites.
- The ***submicron*** intermediate phase is formed ***collectively*** by the ***nanoscale*** FMM and COI phases, distinctive from the previously identified submicron FMM and COI phases.
- Two **distinct** phase separation length scales (nano and submicron) exists **simultaneously** in one system.
- The weak magnetization and high resistivity of the intermediate phase is the inevitable results of its nanoscale mixture nature.

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