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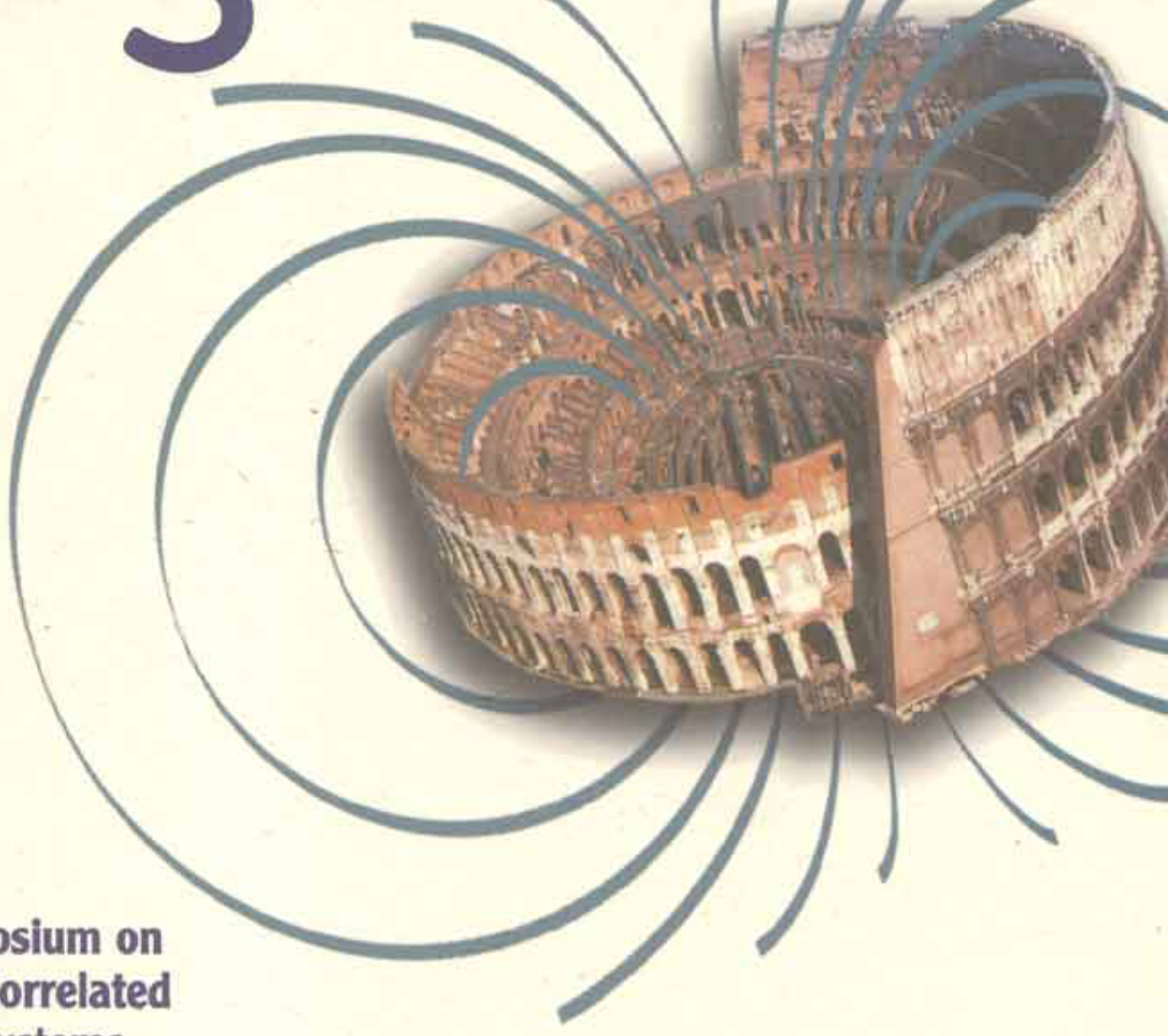

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abstracts

5U-am-26—— COEXISTENCE OF FERROMAGNETIC AND PARAMAGNETIC PHASES IN $Ti_{0.995}{}^{57}Fe_{0.005}O_2$

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Recently, oxide-diluted magnetic semiconductors have been extensively studied and the origin of ferromagnetism in semiconductors remains an issue of debate[1-2]. In this study, we investigated magnetic behavior of TiO_2 with only a minute amount of Fe and separated contributions of the ferromagnetic and the paramagnetic phases to the magnetization. $Ti_{0.995}{}^{57}Fe_{0.005}O_2$ compounds were fabricated using the chemical solution method. The x-ray and neutron diffraction patterns for the sample showed a pure anatase single phase with a tetragonal structure, without any segregation of Fe into particulates within the instrumental resolution limit. Magnetic properties were characterized by the vibrating sample magnetometer (VSM) and Mössbauer spectroscopy with a ^{57}Co(Rh) source. Room temperature magnetic hysteresis(*M-H*) curve showed an obvious ferromagnetic behavior and the magnetic moment per Fe atom under the applied field of 1 T was estimated to be about 0.067 μ_B, verified using Mössbauer measurement. Mössbauer spectra of $Ti_{0.995}{}^{57}Fe_{0.005}O_2$ were taken at various temperatures ranging from 14 to 295 K. Results showed that the ferromagnetic (sextet) and the paramagnetic phase (doublet) coexisted in all temperature ranges. The isomer shift values are attributed to the Fe^{3+} state of iron that was present in the sample. Separation of the ferromagnetic and the paramagnetic phase of the samples was characterized by Mössbauer technique. The occupied area ratio of the ferromagnetic phase was about 64 and 51 %, at 14 and 295 K, respectively. This result corresponded with *M-H* curve referred above. The observed small magnetic moment in the *M-H* curve was fundamentally attributable to paramagnetic phase as well as ferromagnetic phase.

[1] Y. Matsumoto et al. Science 291 (2001) 854
[2] P. A. Stampe et al. J. Appl. Phys. 92 (2002) 7114