Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

The quantum to classical transition in atomic scale magnets FERNANDO DELGADO, JOAQUIN FERNANDEZ-ROSSIER, International Iberian Nanotechnology Laboratory (INL), Av. Mestre Jose Veiga, 4715-330 Braga, Portugal — Understanding the emergence of classical behavior in a world governed by quantum mechanics at the microscopic scale is one of the main fundamental open problems in physics. The radical differences between the two behaviors is dramatically represented by quantum systems that are, at the same time, in two classically different states. The quantum to classical transition is empirically linked to the size of the systems and conceptually related to the concept of environmental decoherence [1], but no general and clear rules have been determined. Here we consider it in the context of atomically engineered magnetic nanostructures [2,3] and we address fundamental questions such as the conditions under which a single adatom can behave classically or quantum mechanically. We show that the phase transition depends on the relative strength of its exchange coupling to surface and the renormalized zero-field splitting induced by quantum spin tunneling.

[1] W. H. Zurek, Physics Today 44, 36 (1991).
[2] C. F. Hirjibehedin et al., Science 312, 1021 (2006).
[3] C. Hirjibehedin et al., Science 317, 1199 (2007).

Fernando Delgado
International Iberian Nanotechnology Laboratory (INL),
Av. Mestre Jose Veiga, 4715-330 Braga, Portugal

Date submitted: 17 Nov 2012 Electronic form version 1.4