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Laser-induced ultrafast spin dynamics in di-, tri- and tetranuclear nickel clusters, and the M process DEBAPRIYA CHAUDHURI, Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, Germany, HONGPING XIANG, Department of Physics and Astronomy, California State University Northridge, California, USA, GEORGIOS LEFKIDIS, WOLFGANG HÜBNER, Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, Germany — We present a theoretical investigation of the ultrafast magneto-optical dynamics in clusters with 2, 3 and 4 Ni atoms. We study cooperative effects by increasing both the number of active centers and the multiplicities (up to quintets) in our Hilbert space. In the dinuclear cluster Ni_2 a novel spin-flip scenario based on the M process is established[1]. This process is highly operative in case the standard Λ process fails. In the trinuclear cluster Ni_3Na_2 simultaneous spin-flip and spin-transfer is observed. Local spin-switch is also achieved via a non-linear M process which involves two off-resonant transitions. Finally, in the tetranuclear cluster $(Ni_2)_2$ the use of quintets provides an insight into an irreversible demagnetization scenario. We believe that our systematic investigation allows us to establish a relation between the magnetic centers and the multiplicities. Our research represents an important step towards the miniaturization of spintronic devices and functionalization of various logic elements based on molecular structures[2].

[1]D. Chaudhuri, H. P. Xiang, G. Lefkidis and W. Hübner, Phys. Rev. B, in print (2014).
[2]W. Hübner, S. Kersten and G. Lefkidis, Phys. Rev. B **79**, 184431 (2009).

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