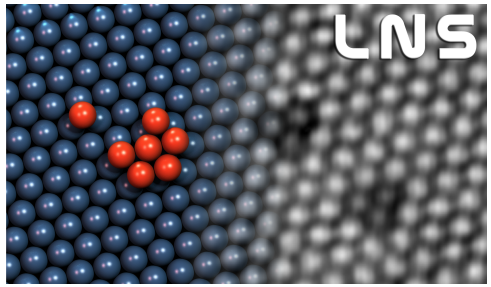
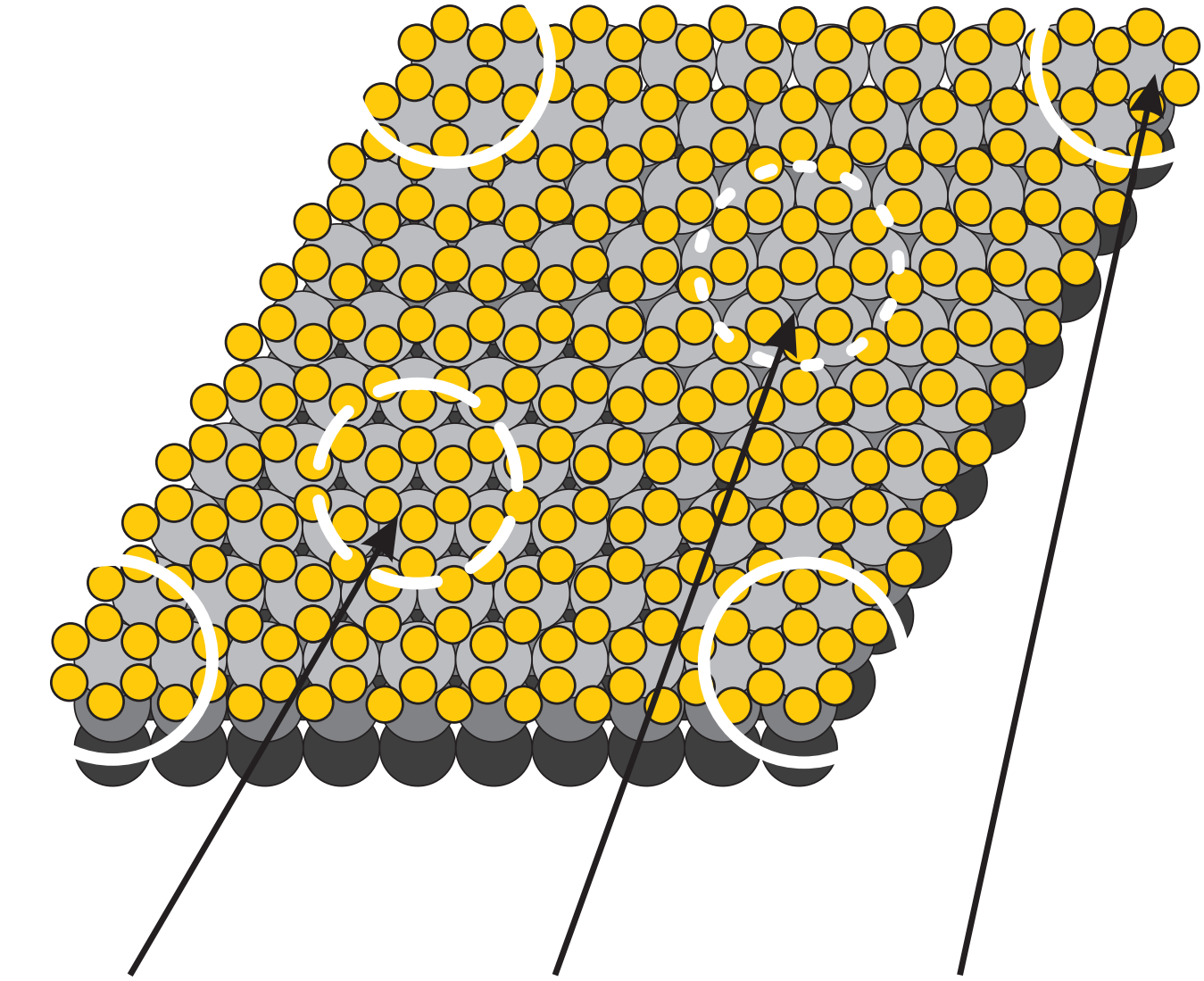
Nanostructures at Surfaces

1. Growth of Nanostructures by Self-Assembly
2. Magnetism
3. Single Ion Molecular Magnets
4. Single Atom Magnets

EPFL

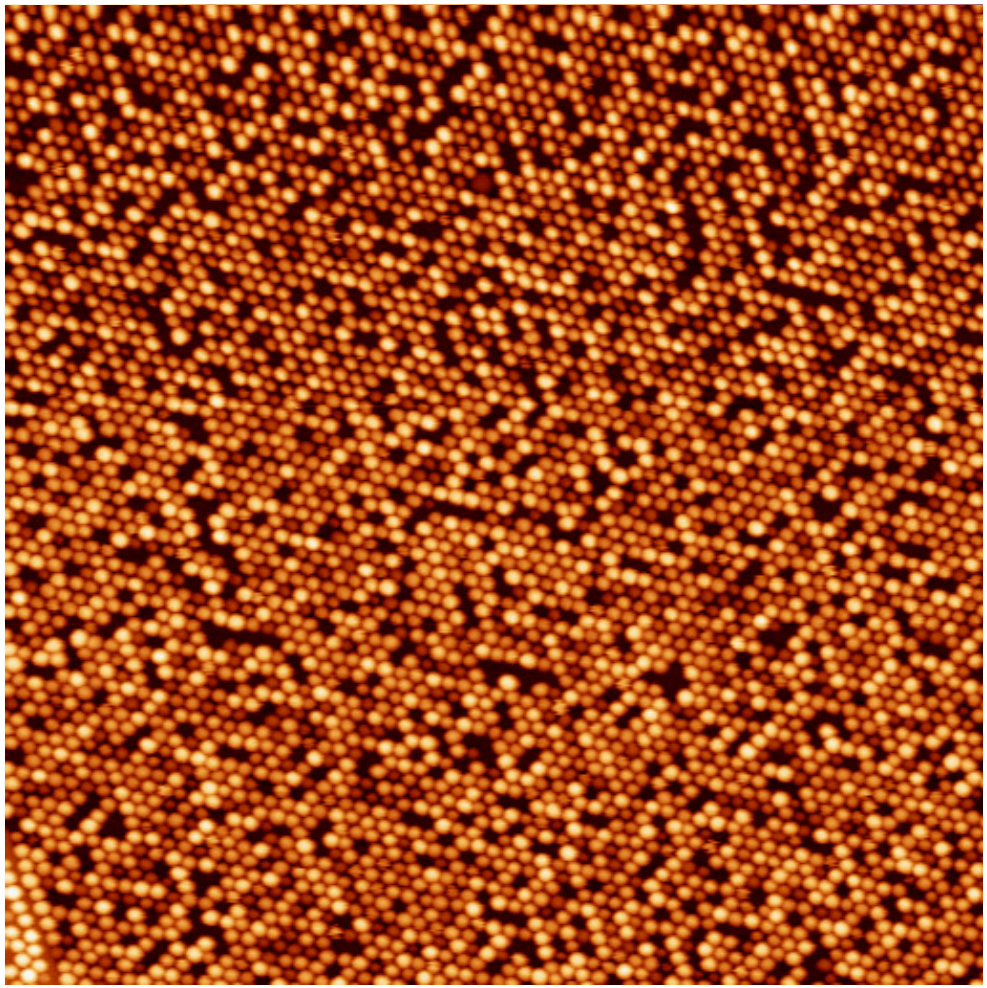


graphene/Ir(111) – (9.32 ± 0.15 *x* 9.32 ± 0.15) moiré structure
– incommensurate epitaxy



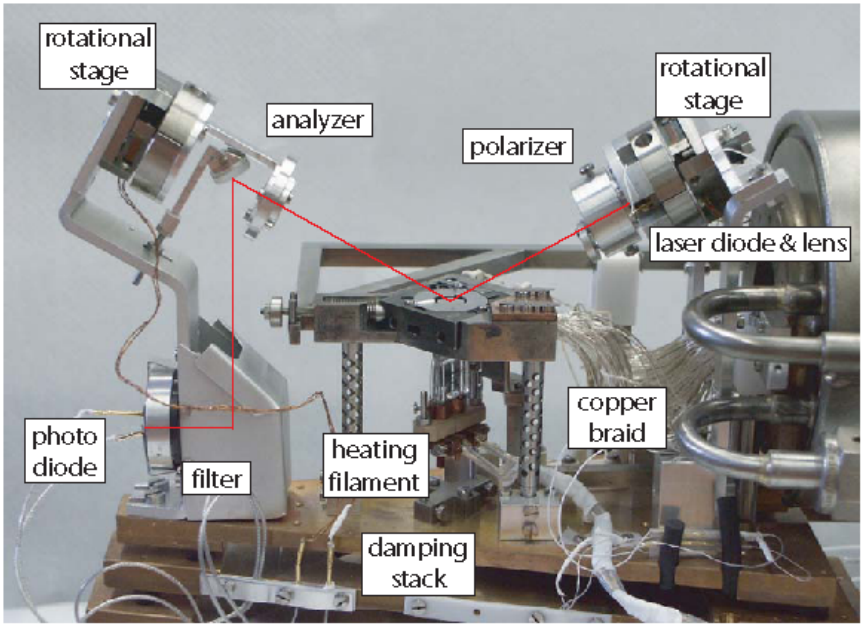
A. T. N' Diaye *et al.*, Phys. Rev. Lett. **97**, 215501 (2006); New J. Phys. **10**, 043033 (2008).

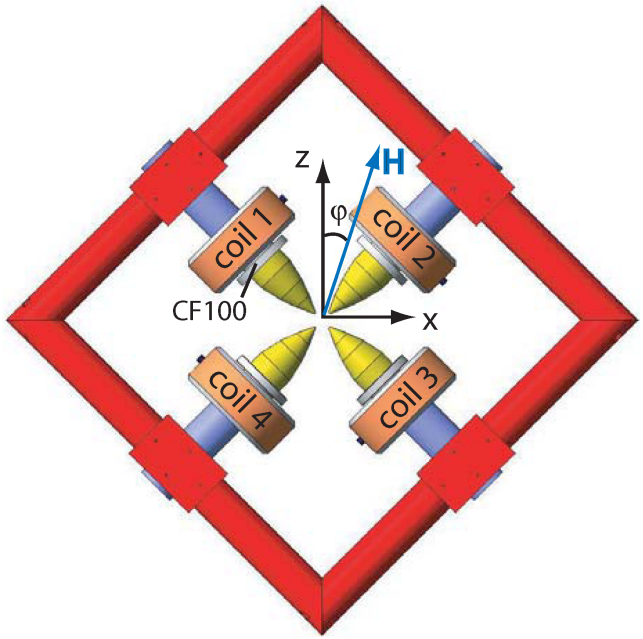
Ir-seeded Co Superlattices on graphene/Ir(111)

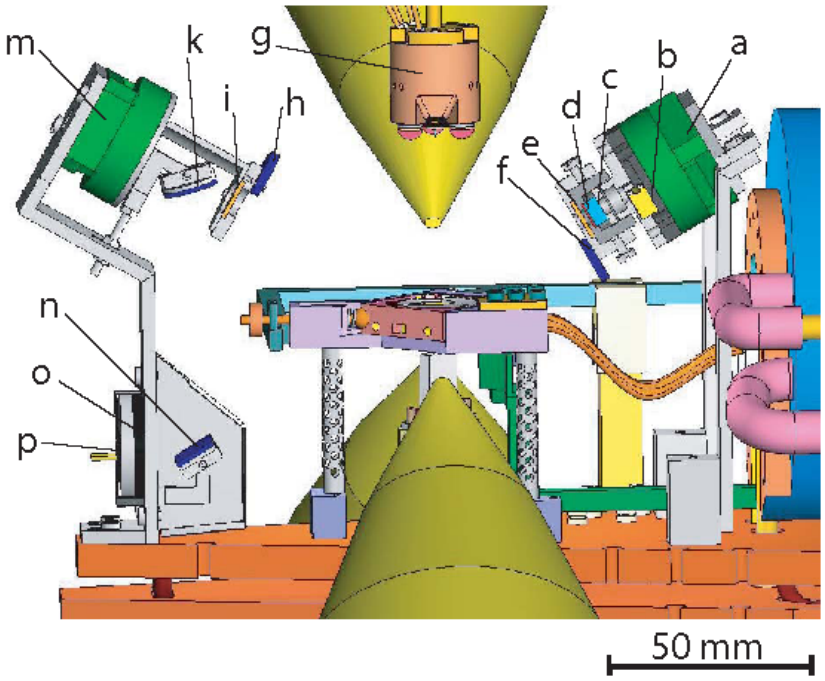


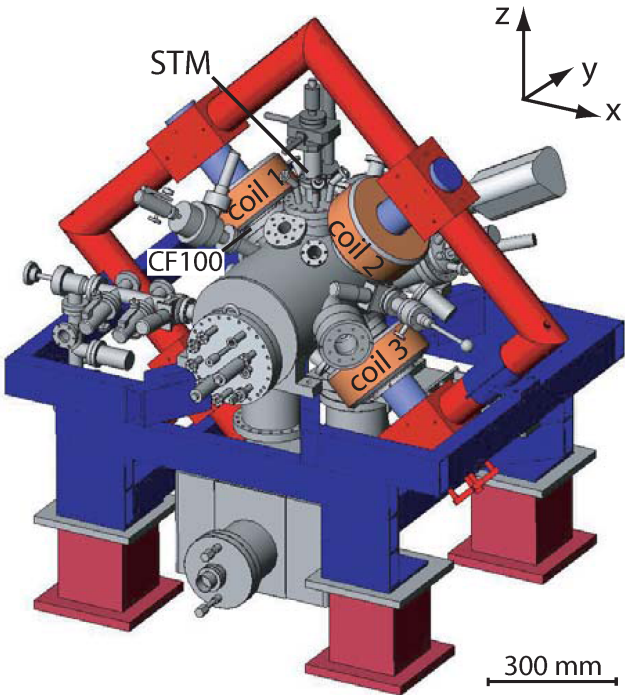
Co/Ir/graphene/Ir(111)-(9.32 ± 0.15 *x* 9.32 ± 0.15), 0.05 ML Ir @ 375 K, 0.10 ML Co @ 300 K

MOKE with vector field and all optics in UHV

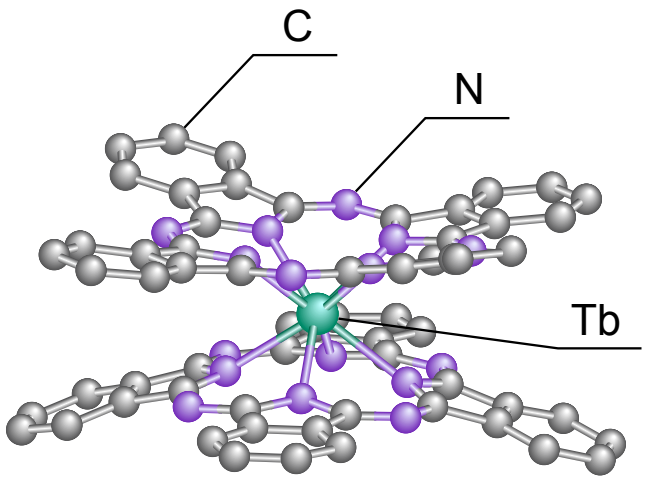








Phthalocyanine (Pc)-Tb – double-decker – Pc_2Tb



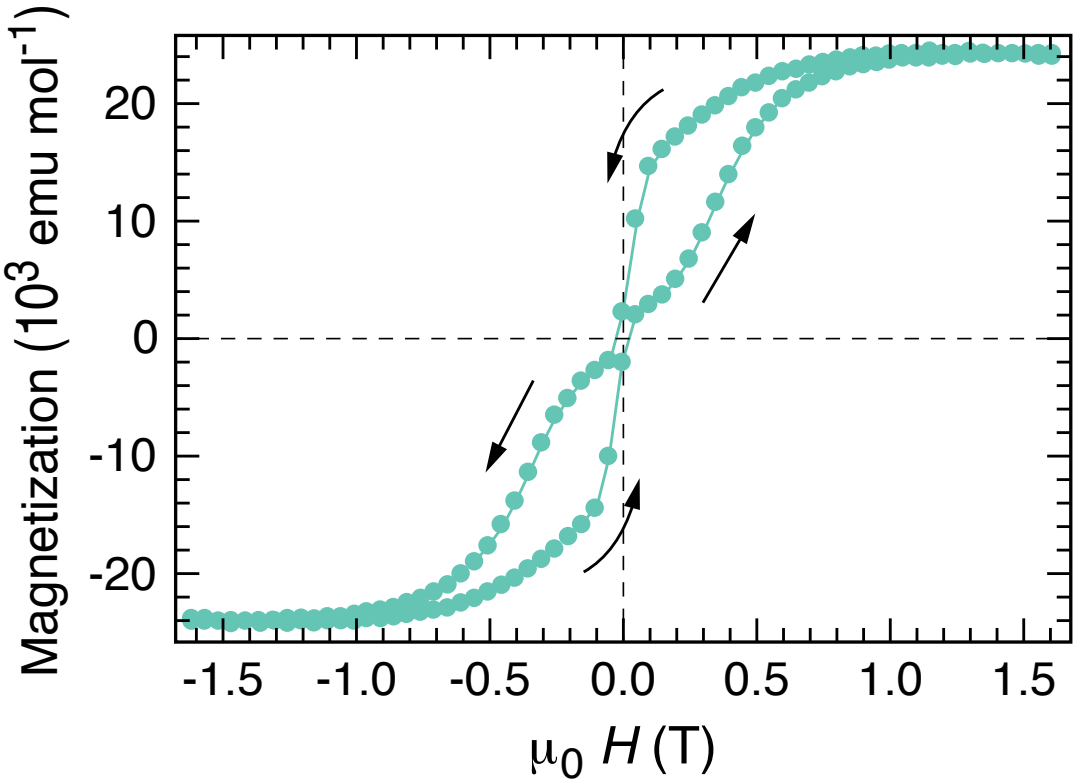
AC $\chi''(T)$: $T_b = 40$ K (1 kHz, 3.5 G),

other SMMs $T_b \leq 7$ K

DC χ (T) and ^{1}H NMR :

$J_z = \pm 6$

$\Delta E = 440$ cm^{-1} to $J_z = \pm 5$



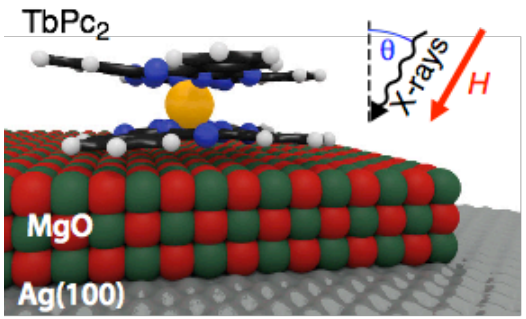
SQUID, $T = 1.7$ K

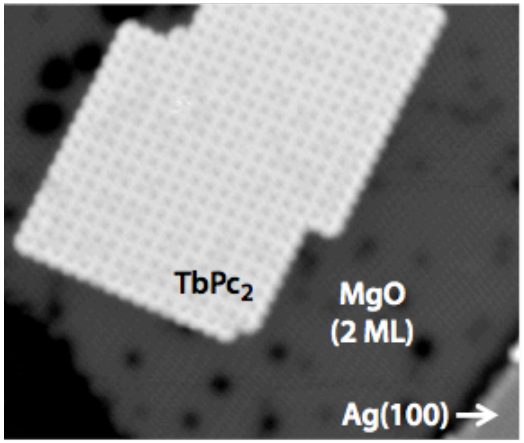
powder sample of 2 % $[Pc_2Tb]^-$ TBA^+

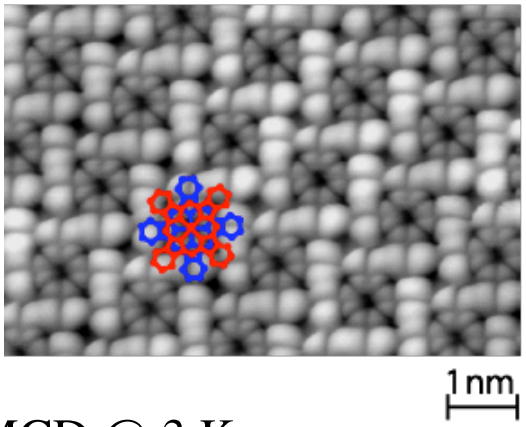
in 98 % $[Pc_2Y]^-TBA^+$

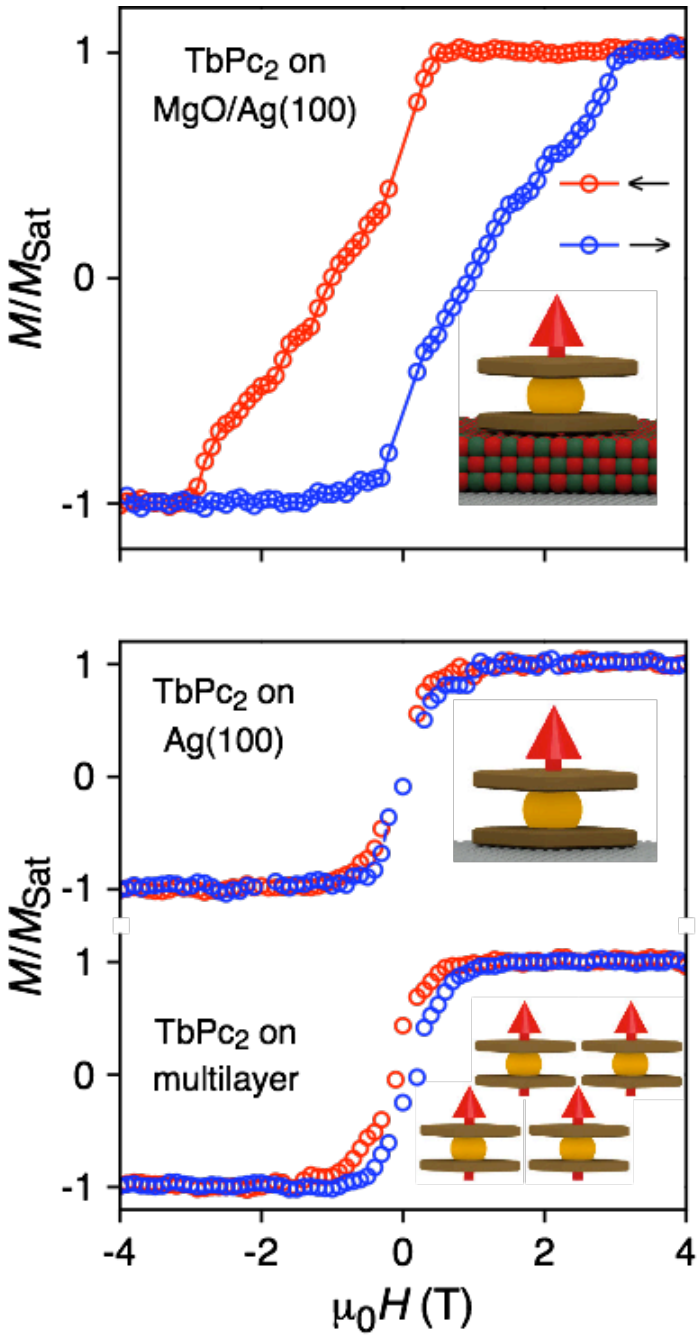
N. Ishikawa *et al.* JACS **125**, 8694 (2003); N. Ishikawa *et al.* JPCB **108**, 11265 (2004).

$Pc_2Tb/MgO/Ag(100)$







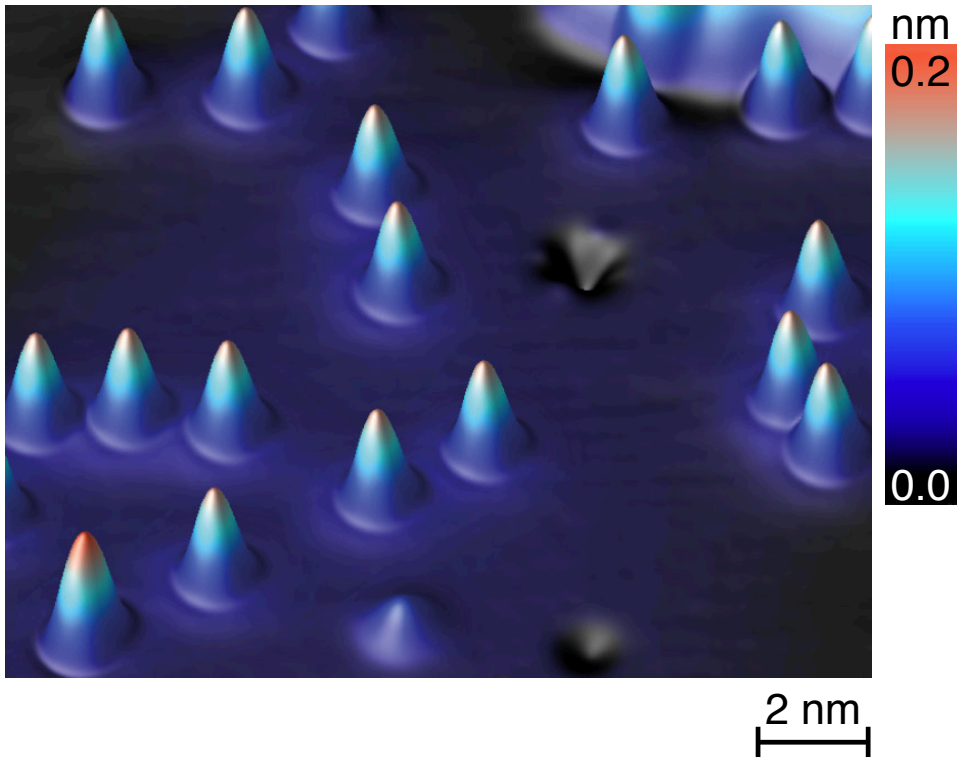


STM @ 4 K, XMCD @ 3 K

C. Wäckerlin *et al.*, Adv. Mater. **28**, 5195 (2016).

Ho/MgO/Ag(100) – Magnetic Hysteresis for Single Atom

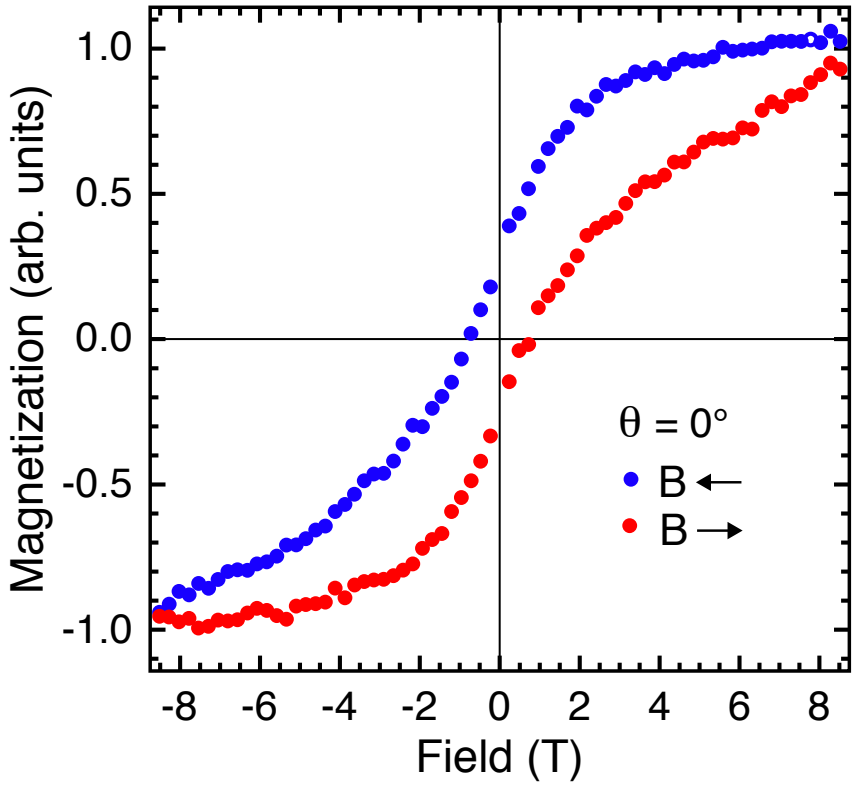
STM



V_t = 100 mV, I_t = 20 pA, T = 4.7 K,
Ho-coverage Θ_{Ho} = 0.005 ML

Ho $4f^{10}$, $J = 8$, $J_z = \pm 4.66$ with large $J_z = \pm 7$ component

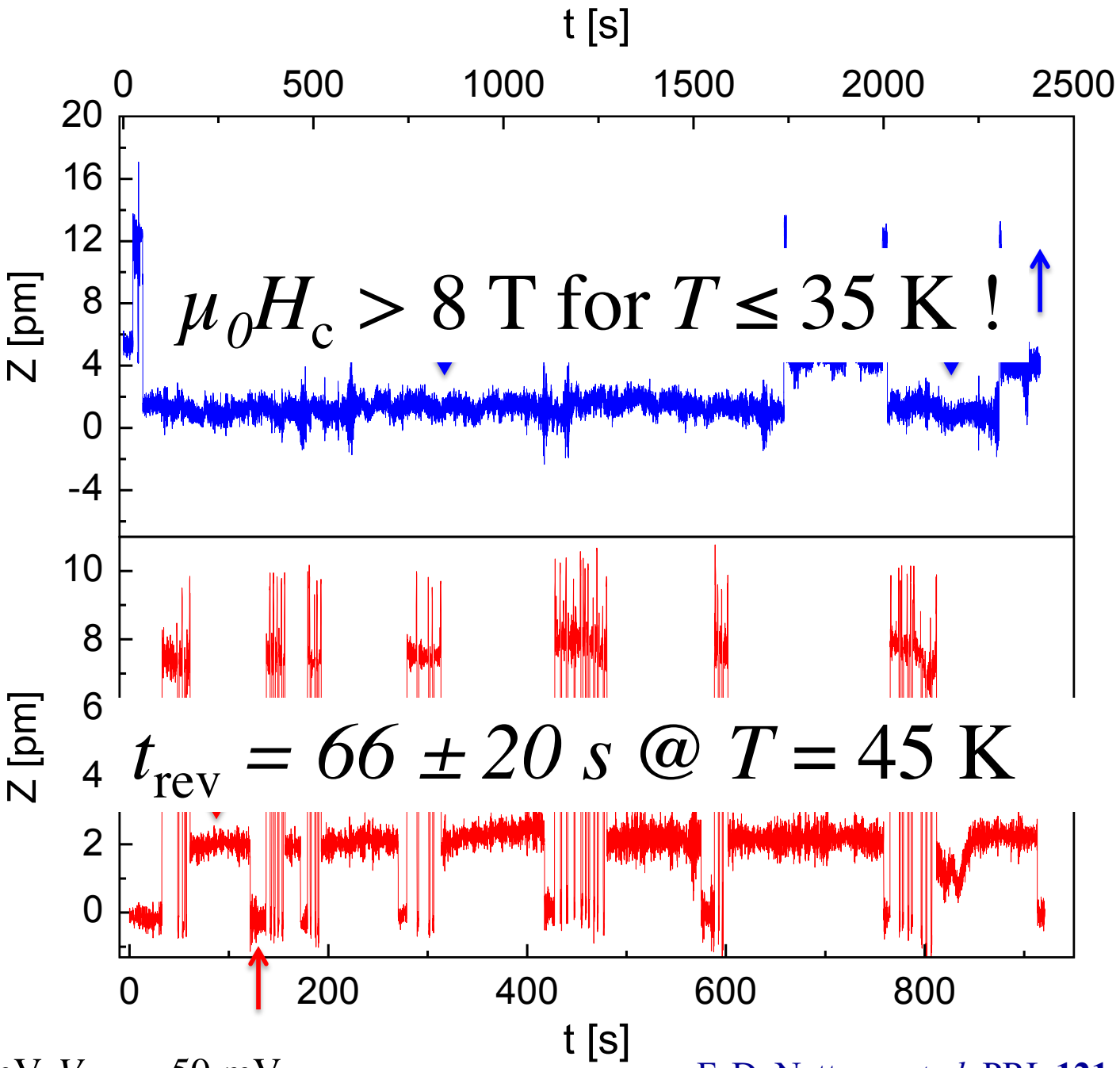
XMCD



T = 6.5 K,
field sweep $\mu_0 dH/dt$ = 8 mT/s,
photon-flux = 1 x 10^{-2} nm^{-2} s^{-1},
Θ_{Ho} = 0.01 ML, Θ_{MgO} = 7.0 ML

F. Donati *et al*. Science **352**, 318 (2016).

Preparation and read-out at 35 and 45 K

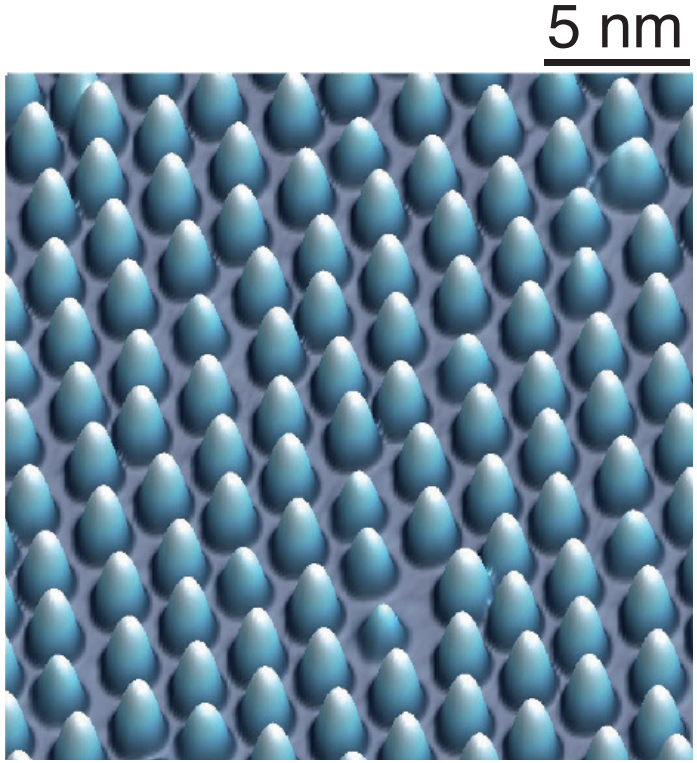


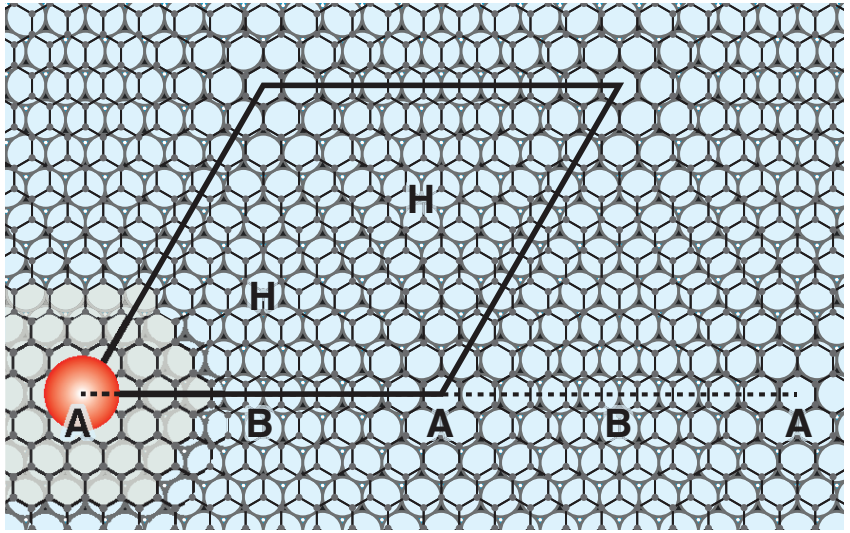
$B = 8$ T up

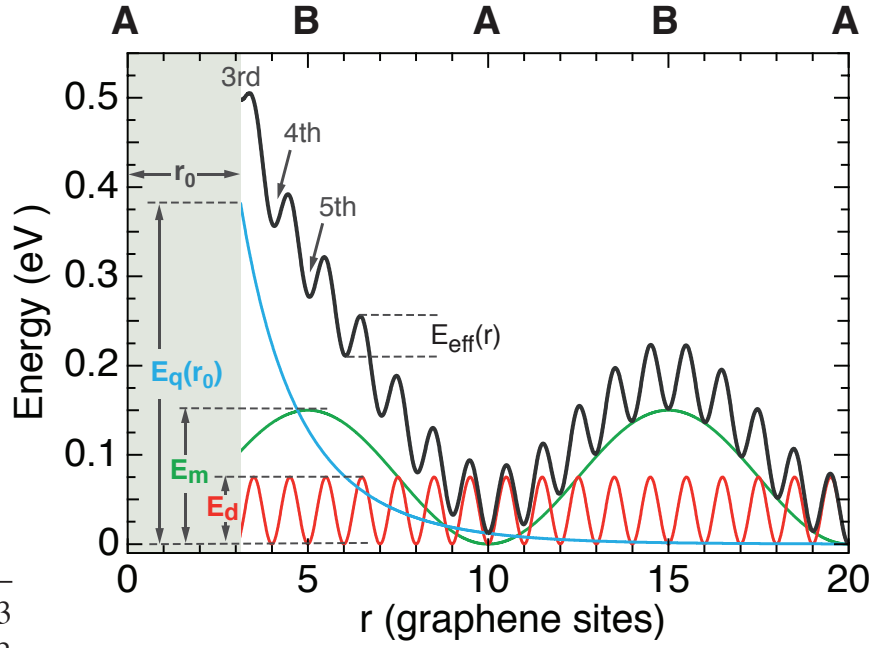
$V_{switch} = 140$ mV, $V_{read} = 50$ mV

F. D. Natterer *et al.* PRL **121**, 027201 (2018).

Repulsion and Charge transfer for Dy/g/Ir(111)



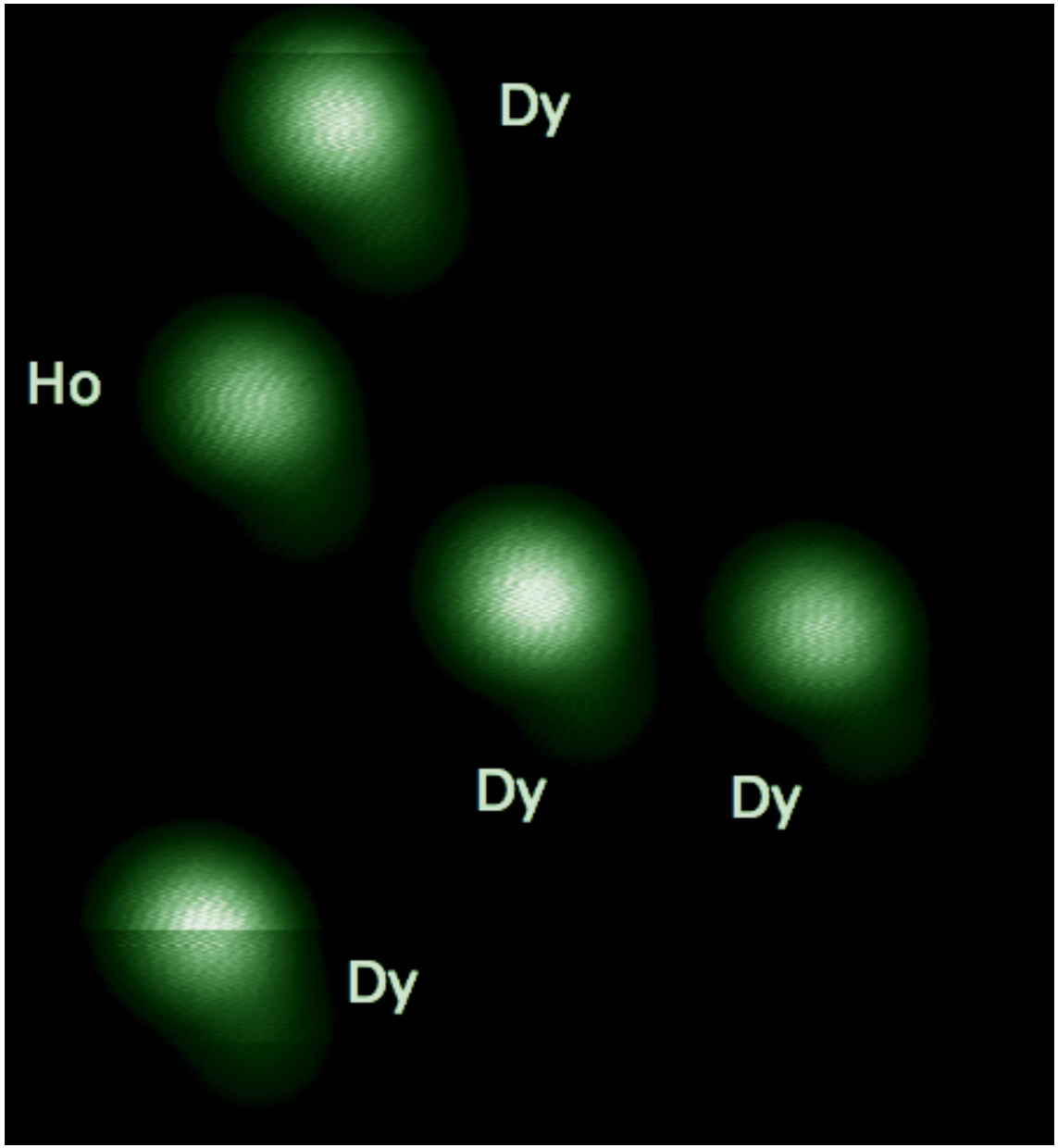




	E_d	E_m	$E_q(r_0)$	q
Dy	75 ± 5	150 ± 30	375 ± 30	0.74 ± 0.03
Sm	100 ± 5	160 ± 30	480 ± 35	0.83 ± 0.03

M. Pivetta *et al.* PRB **98**, 115417 (2018).

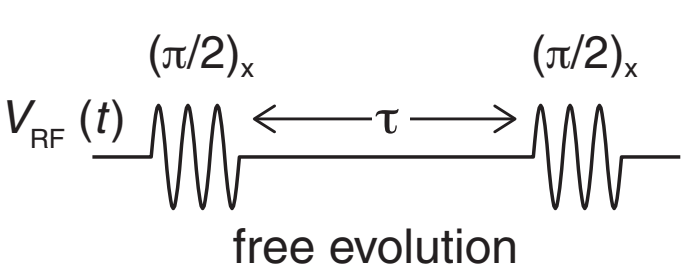
Dy/g/Ir(111) watching single atom magnets switch

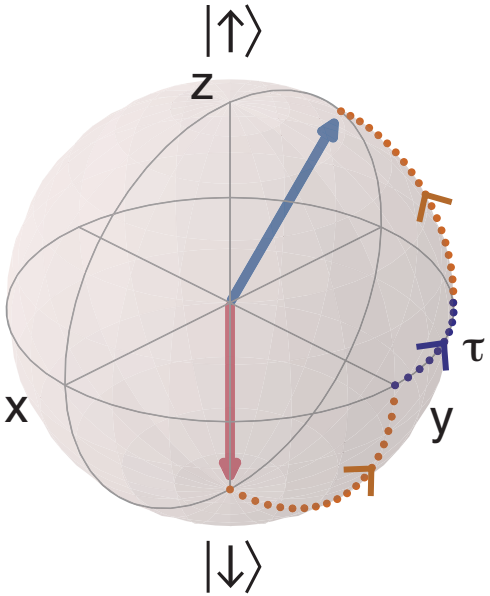


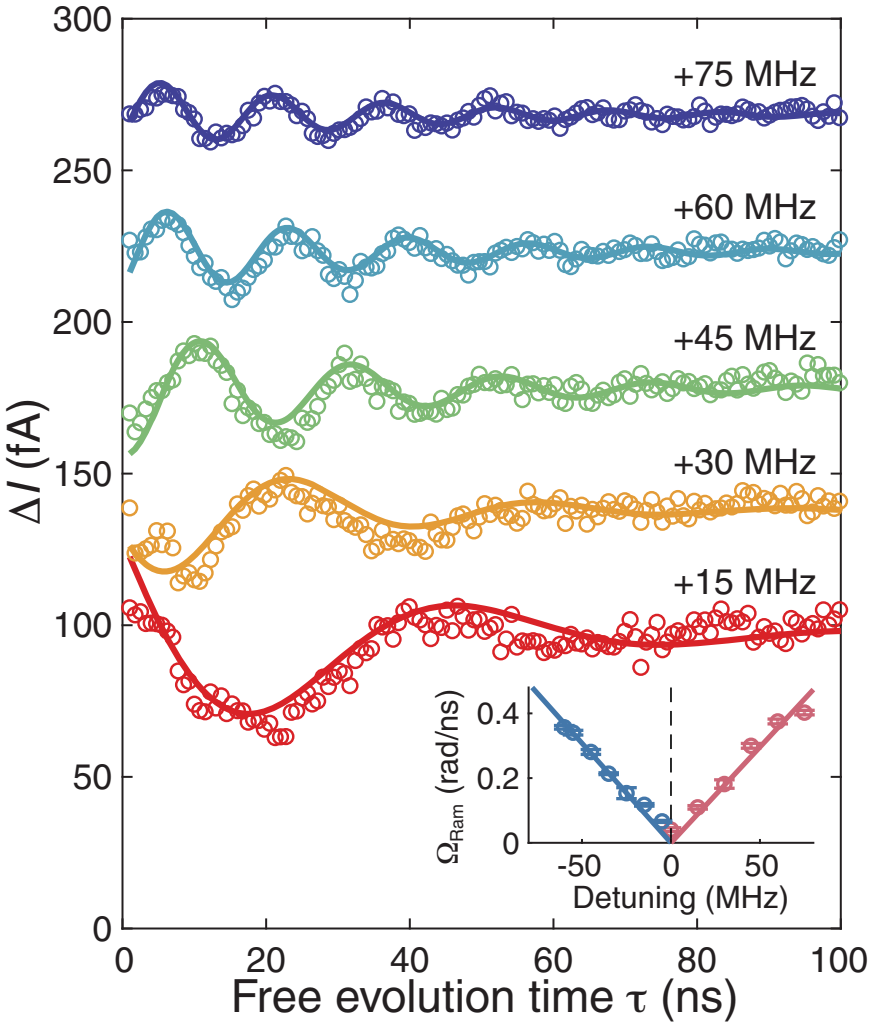
$\Delta z = 35$ pm
$z = 430$ pm

5.4 x 5.8 nm^2
$V_t = +2$ mV
$I_t = 20$ pA
$T_{STM} = 5$ K
$Mn_{88}Ni_{12}$ tip

TiH/MgO/Ag(100): coherent spin manipulation







K Yang *et al.* Science **366**, 509 (2019).