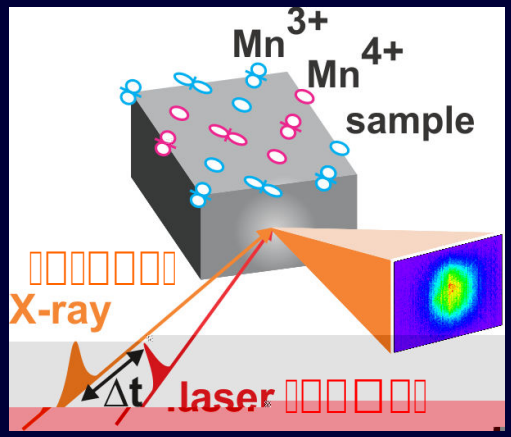
庞磁阻材料的局域化电子序在相变中的超快动态过程研究

清华大学物理系

周树云

凝聚态物理□北京大学论坛 □□□□□□□□□□



[illegible]

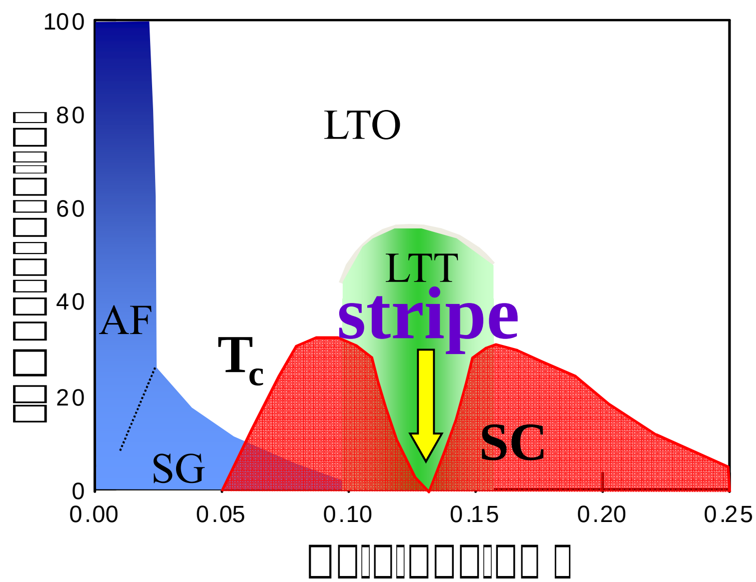
- **Why localized electronic orderings?**
- **How to detect?**
- **Example: Dynamics of antiferromagnetic spin ordering in $Pr_{0.7}Ca_{0.3}MnO_3$ manganite**

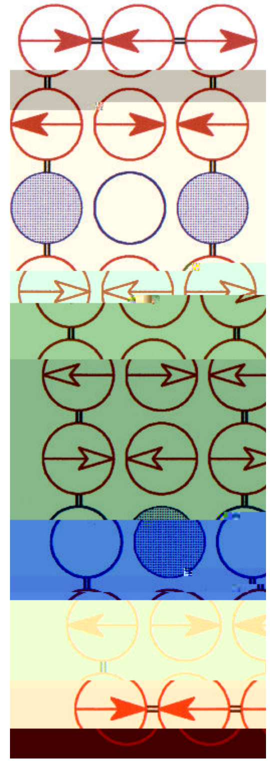
(1) Melting dynamics

(2) Recovery dynamics

- **Conclusions and Perspectives**

$La_{2-x}Ba_xCuO_4$

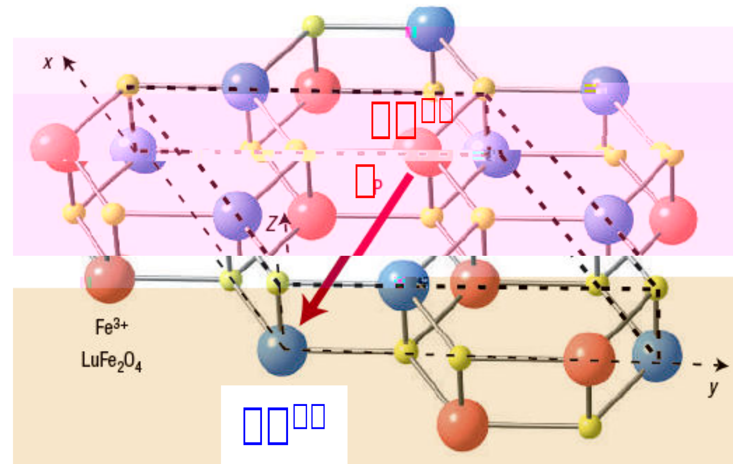


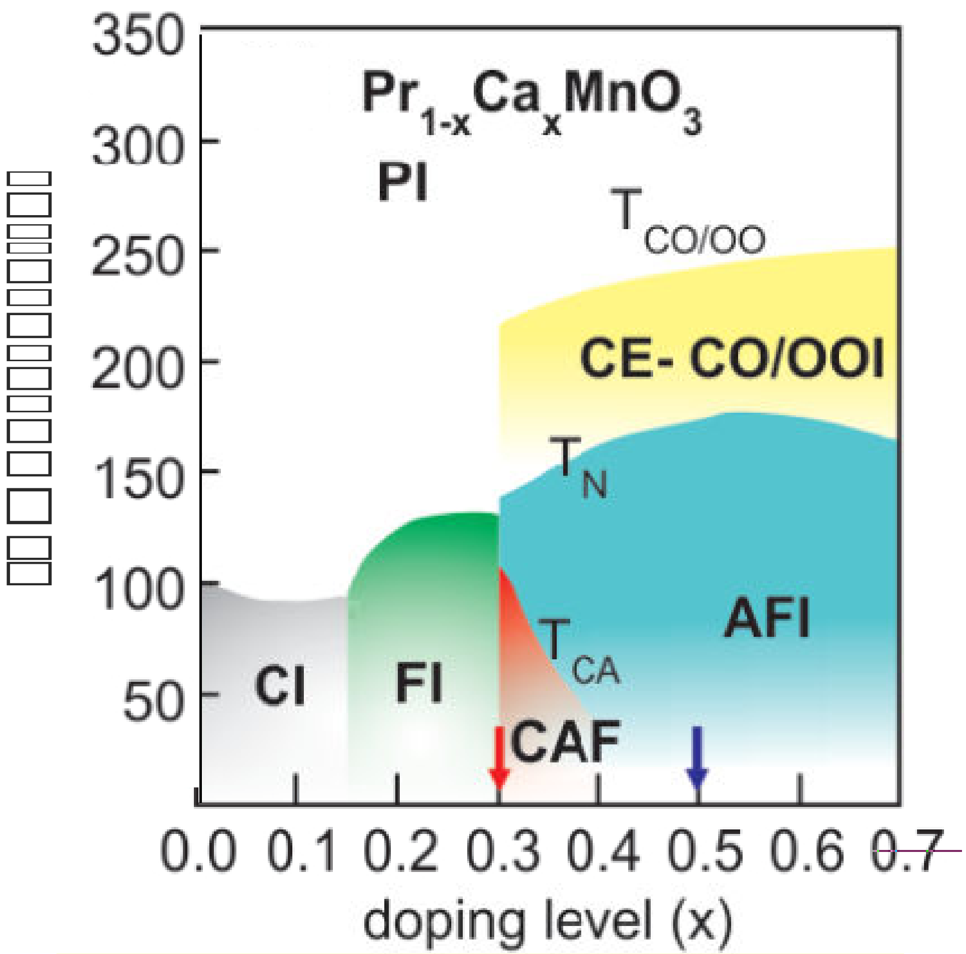


Anomalous suppression of superconductivity at 1/8 doping

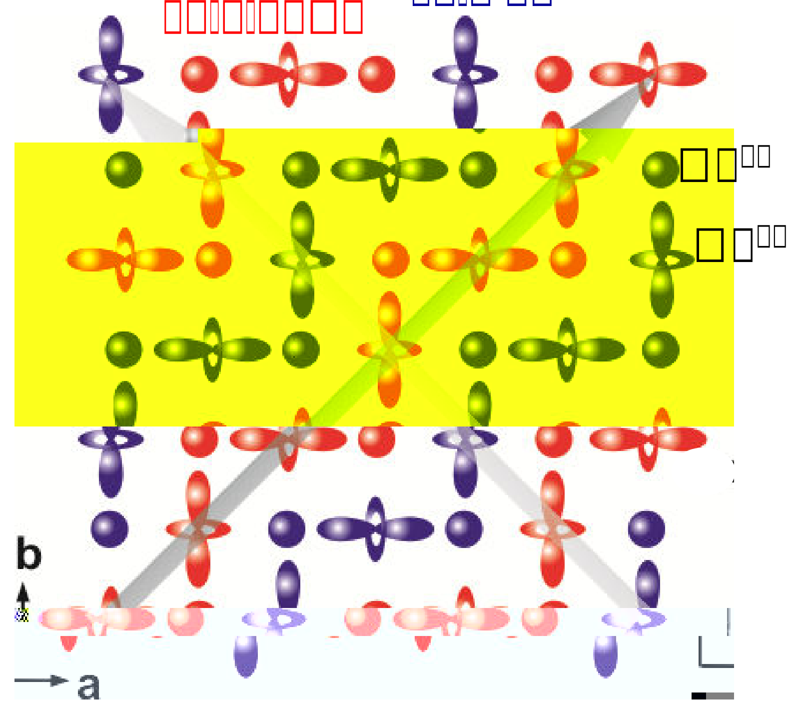
J.M. Tranquada .,
Nature 375, 561 (1995)

$LuFe_2O_4$ (FE, FM)



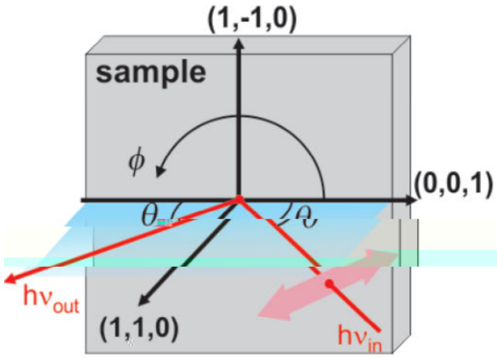


350
300
250
200
150
100
50
$Pr_{1-x}Ca_xMnO_3$
PI
$T_{CO/OO}$
CE- CO/OOI
T_N
AFI
T_{CA}
CI
FI
CAF
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7
doping level (x)



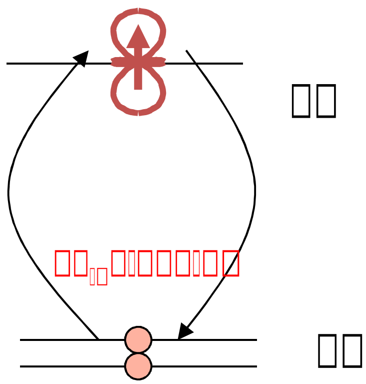
b
a

[illegible]



(1,-1,0)
sample
ϕ
(0,0,1)
$h\nu_{out}$
(1,1,0)
$h\nu_{in}$

[illegible] [illegible]



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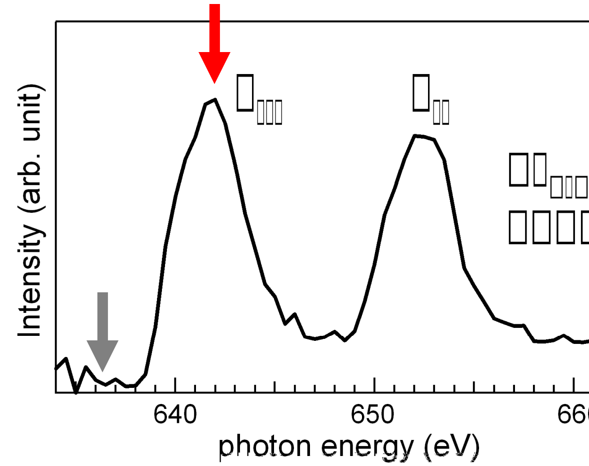
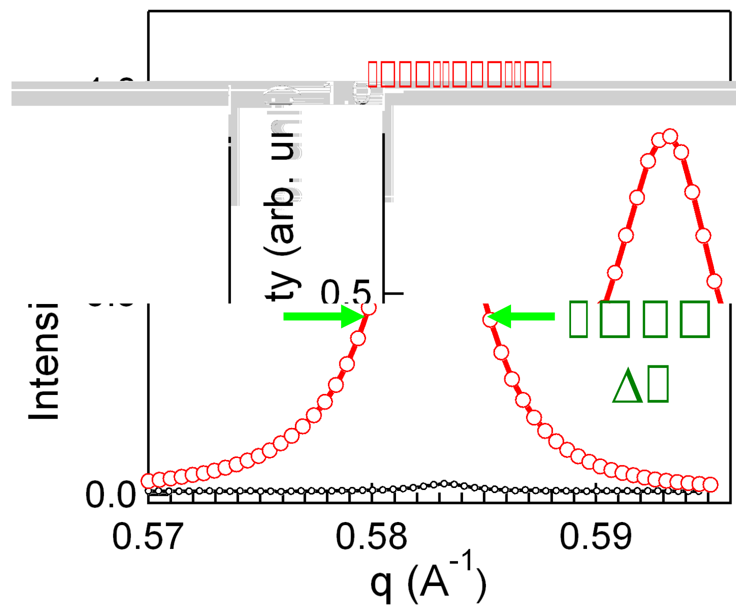


Intensity (arb. unit)
640
650
660
photon energy (eV)



0.5
0.0
Intensi
ty (arb. uni
Δ
0.57
0.58
0.59
q (A^{-1})

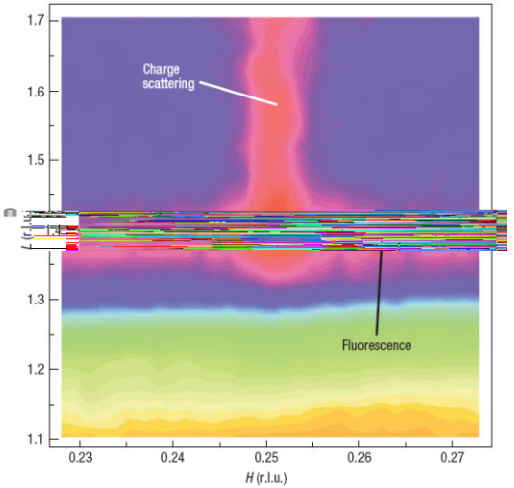
[illegible]

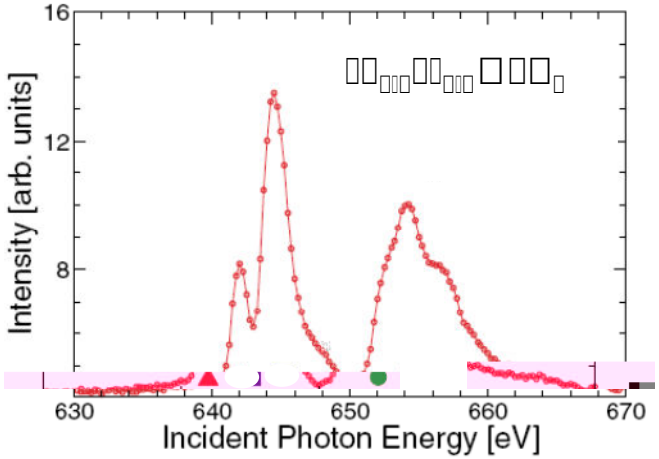
[illegible]

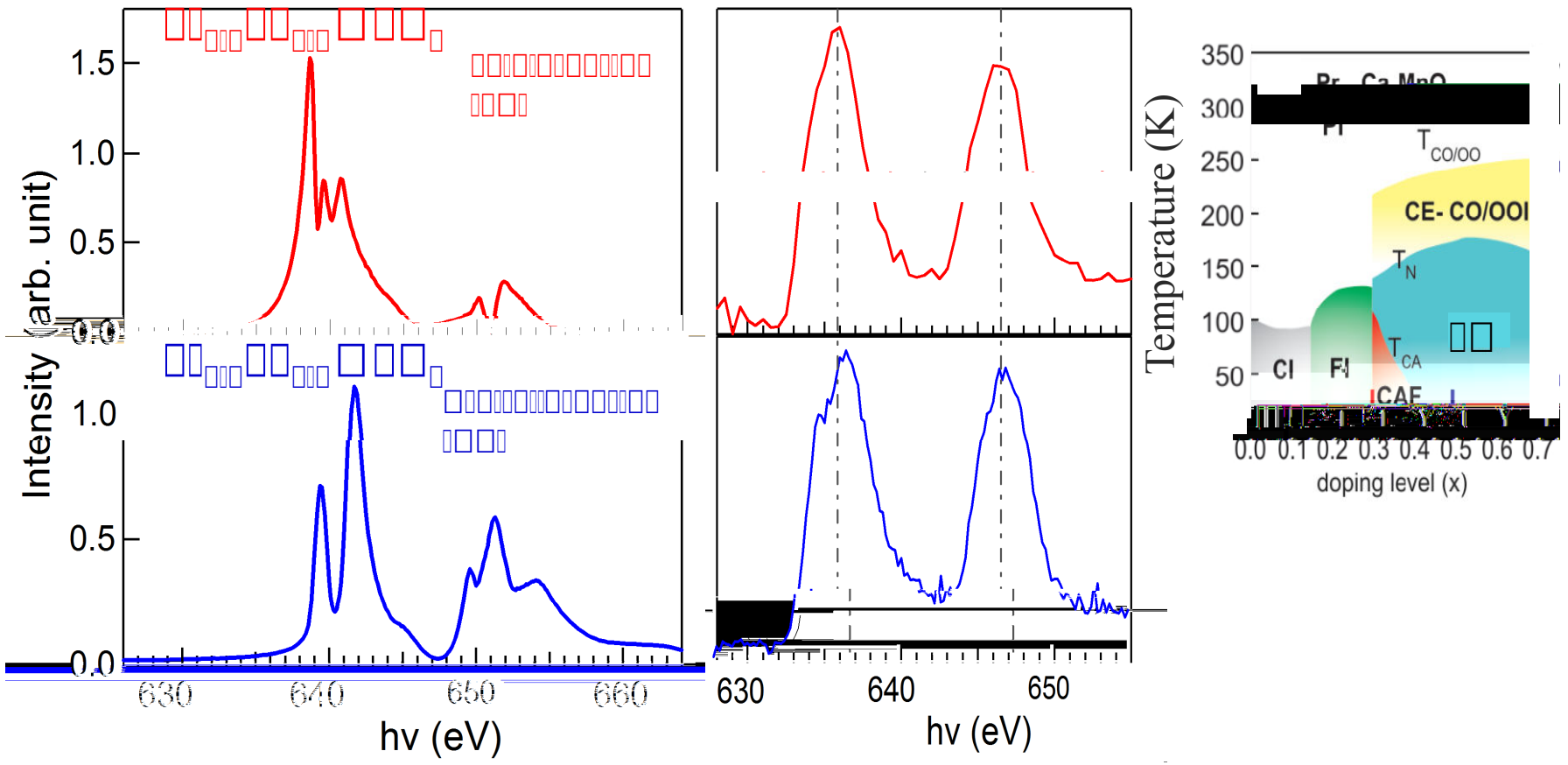
[illegible] ξ [illegible] π [illegible] Δ [illegible]

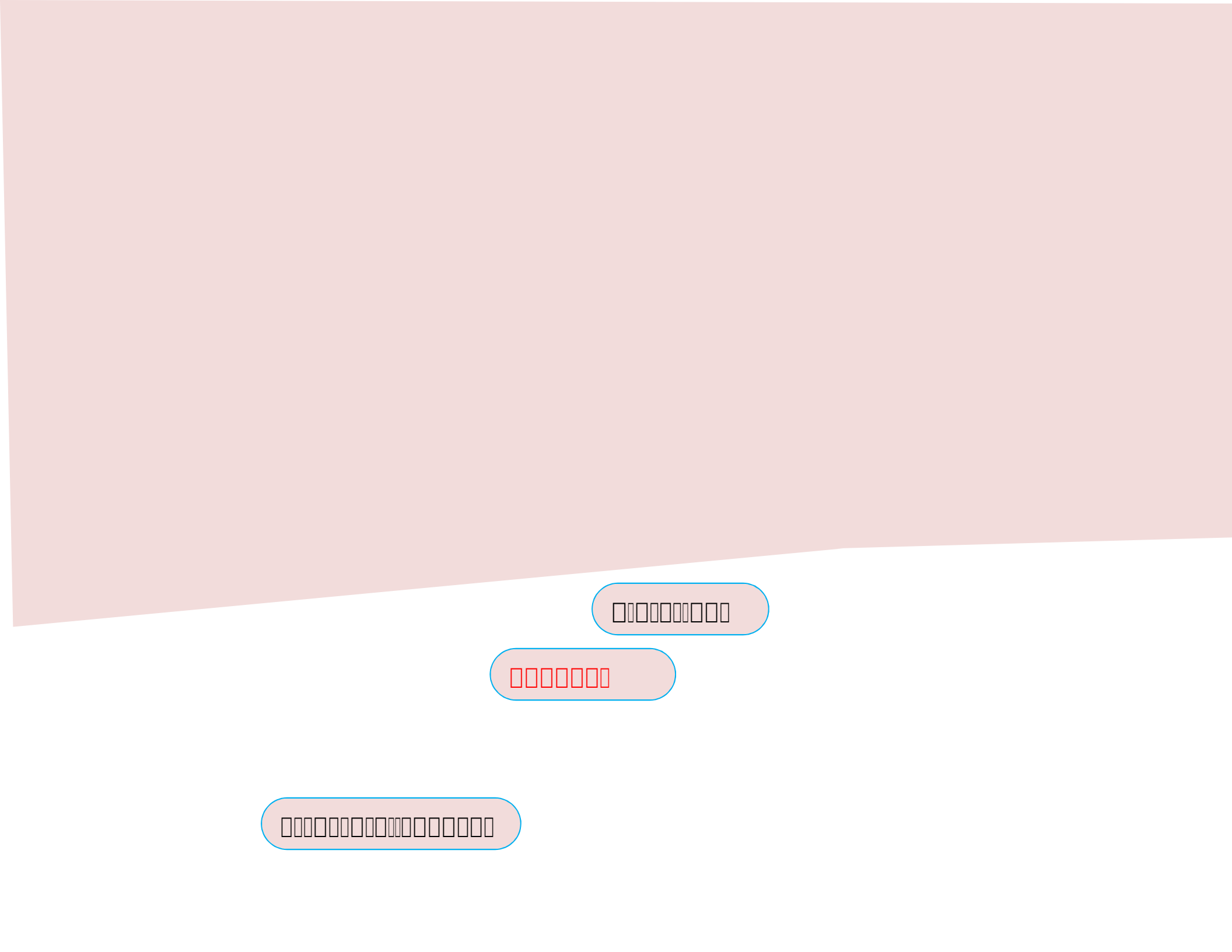
[illegible]

RSXS – A Direct Probe For Electronic Orderings





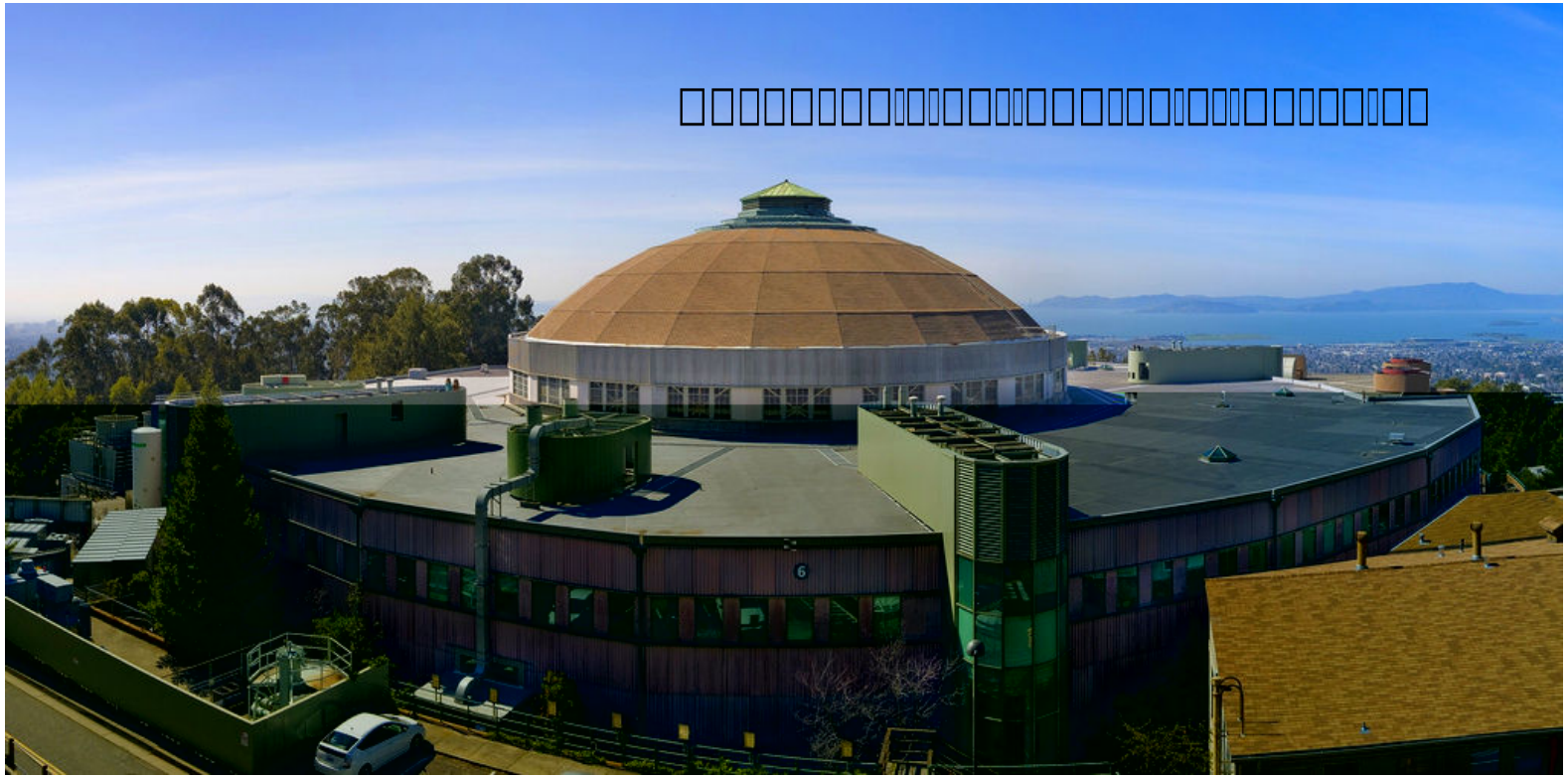

Intensity (arb. unit)
1.5
1.0
0.5
0.0
1.0
0.5
0.0
630
640
650
660
hv (eV)
630
640
650
hv (eV)
Temperature (K)
350
300
250
200
150
100
50
$T_{CO/OO}$
CE- CO/OOI
T_N
T_{CA}
CI
FI
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7
doping level (x)



[illegible]

[illegible]

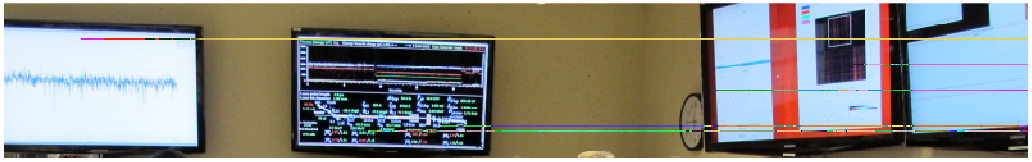
- [illegible]
- [illegible]
- [illegible]
- [illegible]



[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

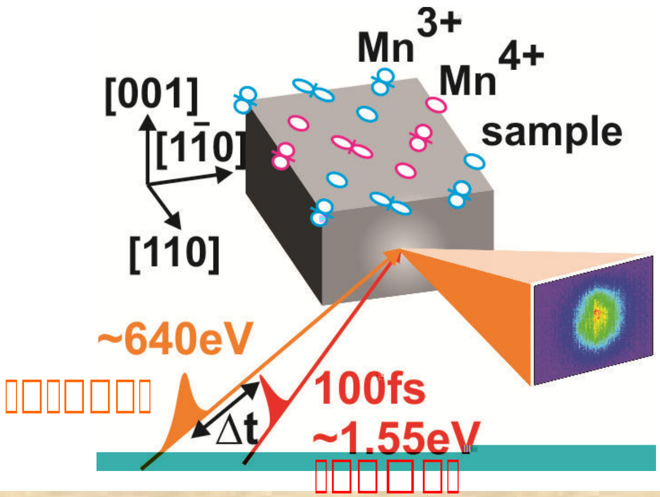


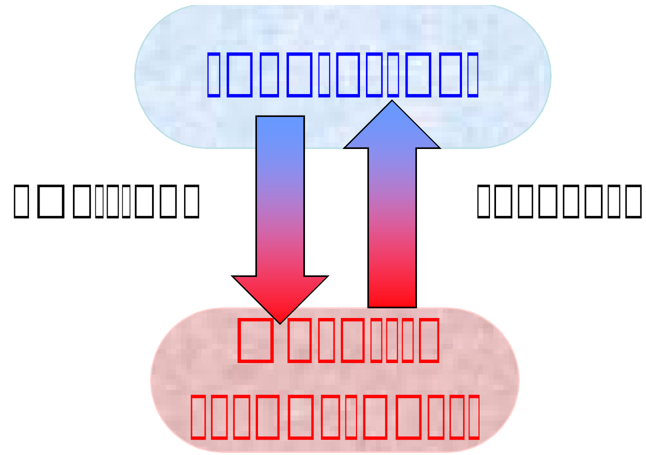
[illegible]

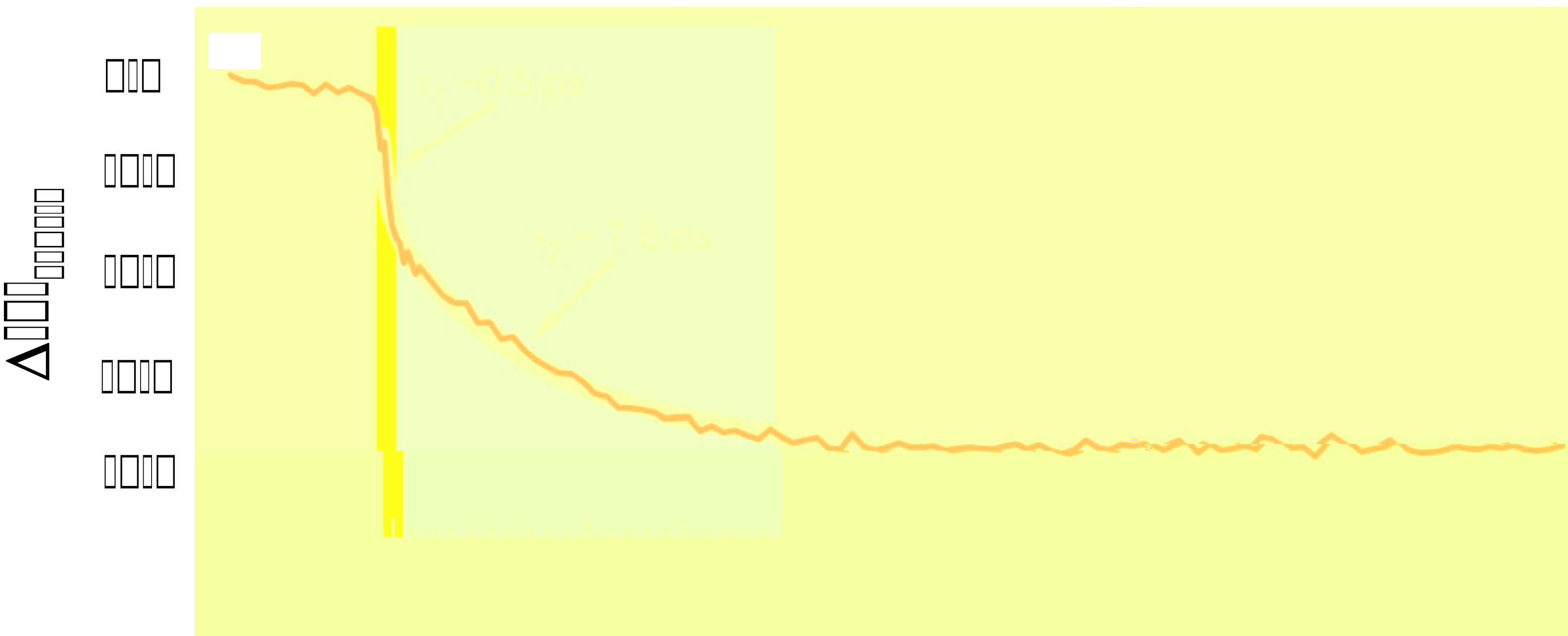
- **Why Localized electronic orderings?**
- **How to detect?**
- **Example: Dynamics of antiferromagnetic spin ordering in $Pr_{0.7}Ca_{0.3}MnO_3$ manganite**

(1) Melting dynamics

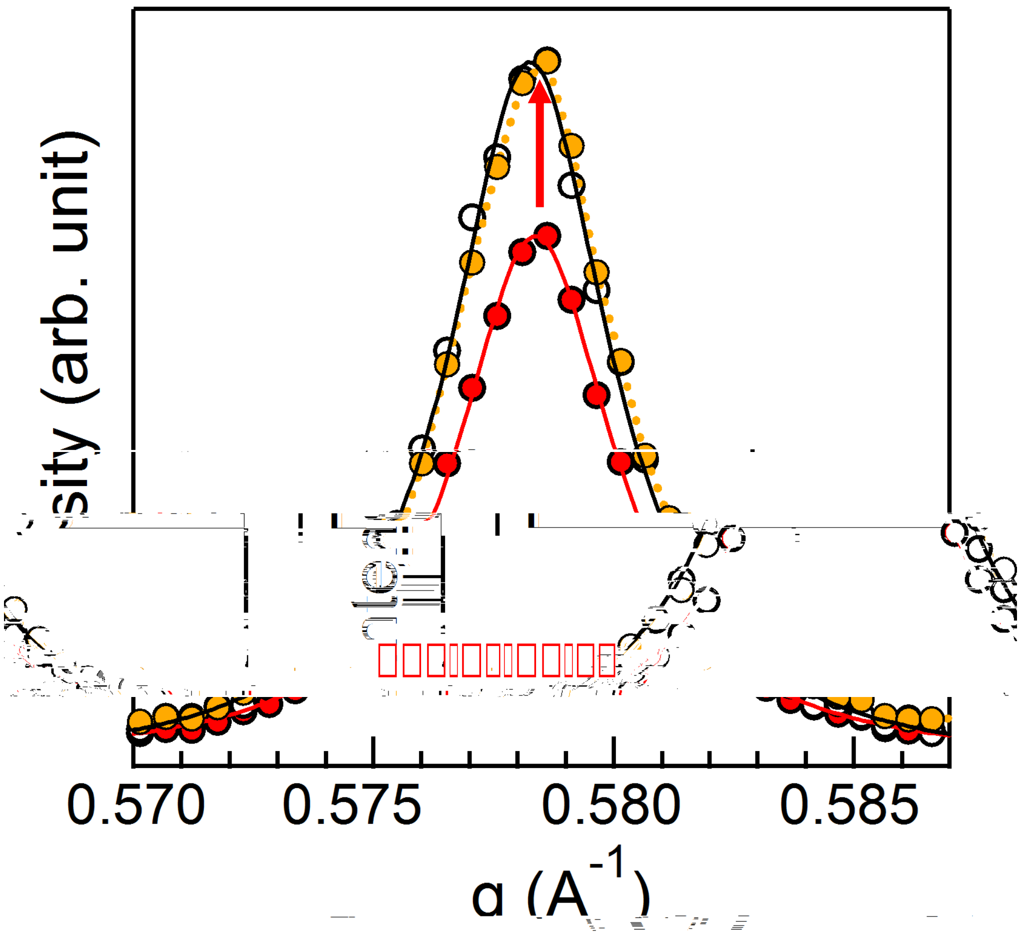
(2) Recovery dynamics

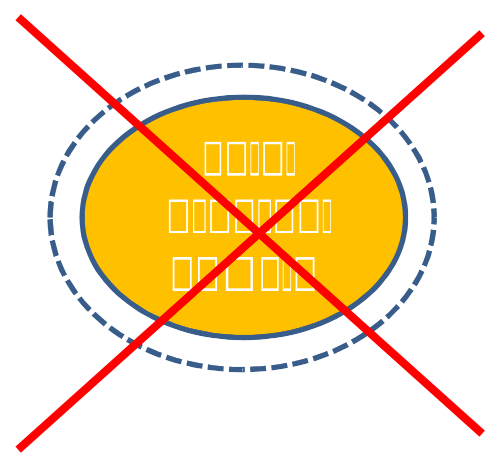

Mn3+
Mn4+
sample
[001]
[1-10]
[110]
~640eV
100fs
~1.55eV
Δt





τ_1 ~0.5 ps
τ_2 ~ 7.8 ps


sity (arb. unit)
0.570
0.575
0.580
0.585
q (A-1)



[illegible]

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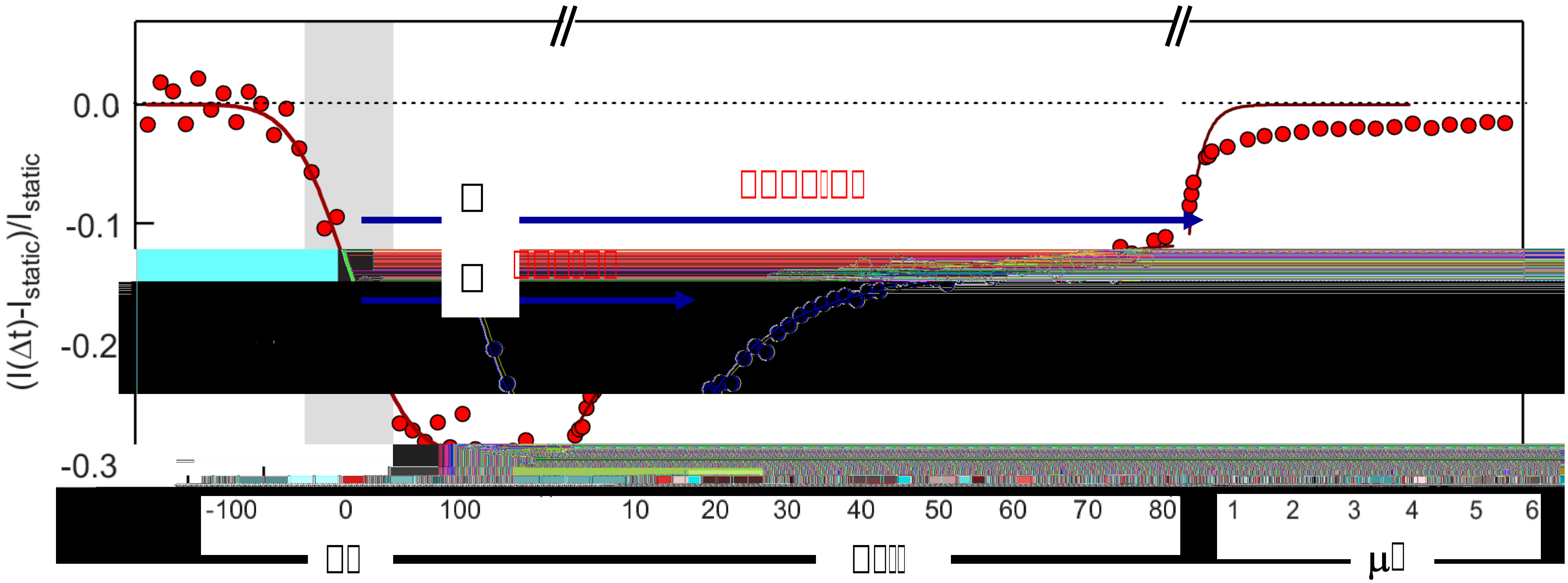
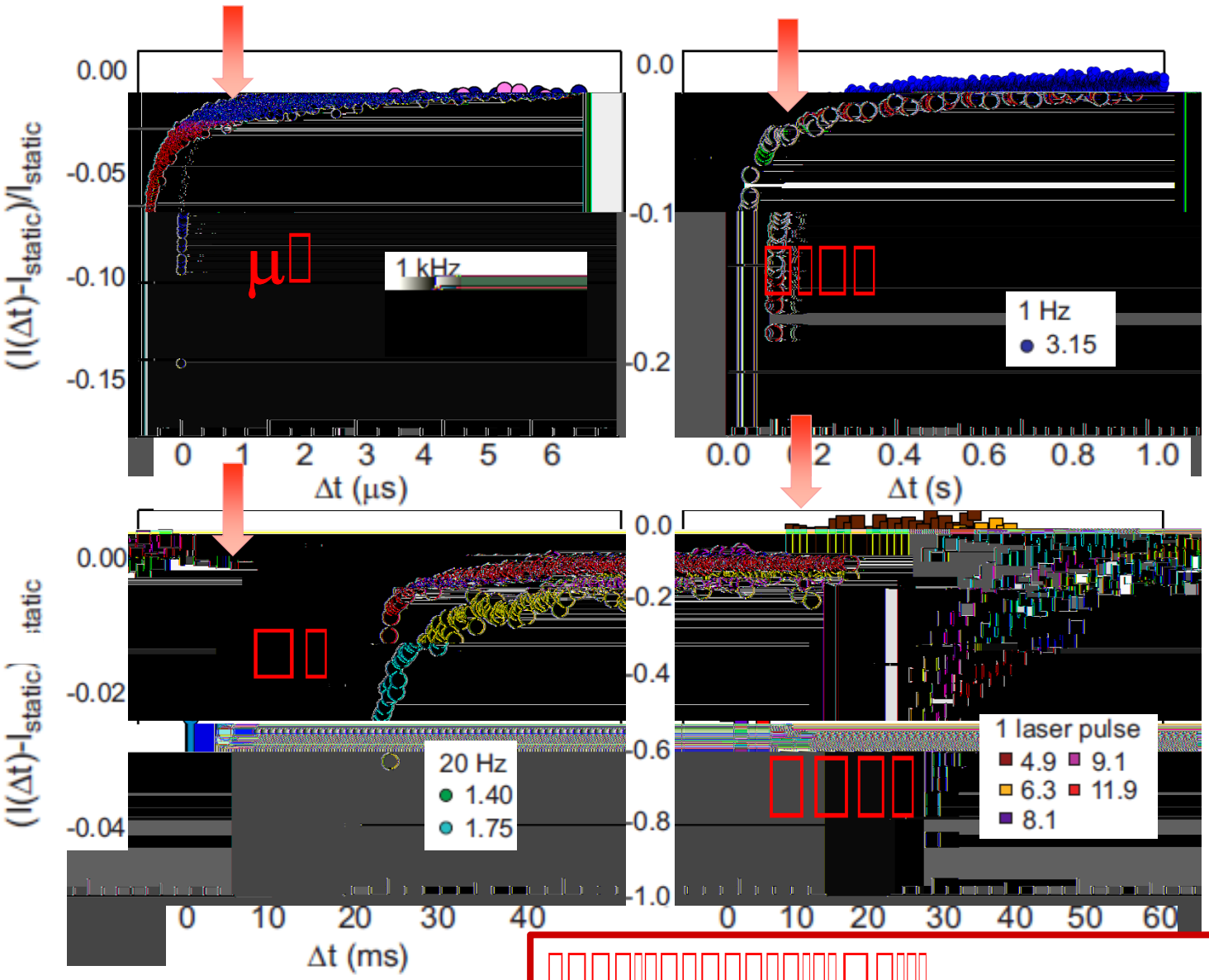
[illegible]



0.0
-0.1
-0.2
-0.3
(I(Δt)-I_static)/I_static
-100
0
100
10
20
30
40
50
60
70
80
1
2
3
4
5
6

[illegible]


0.00
-0.05
-0.10
-0.15
μ
1 kHz
0 1 2 3 4 5 6
Δt (μs)
0.0
-0.1
-0.2
1 Hz
3.15
0.0 0.2 0.4 0.6 0.8 1.0
Δt (s)
0.00
-0.02
-0.04
20 Hz
1.40
1.75
0 10 20 30 40
Δt (ms)
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
1 laser pulse
4.9
9.1
6.3
11.9
8.1
0 10 20 30 40 50 60

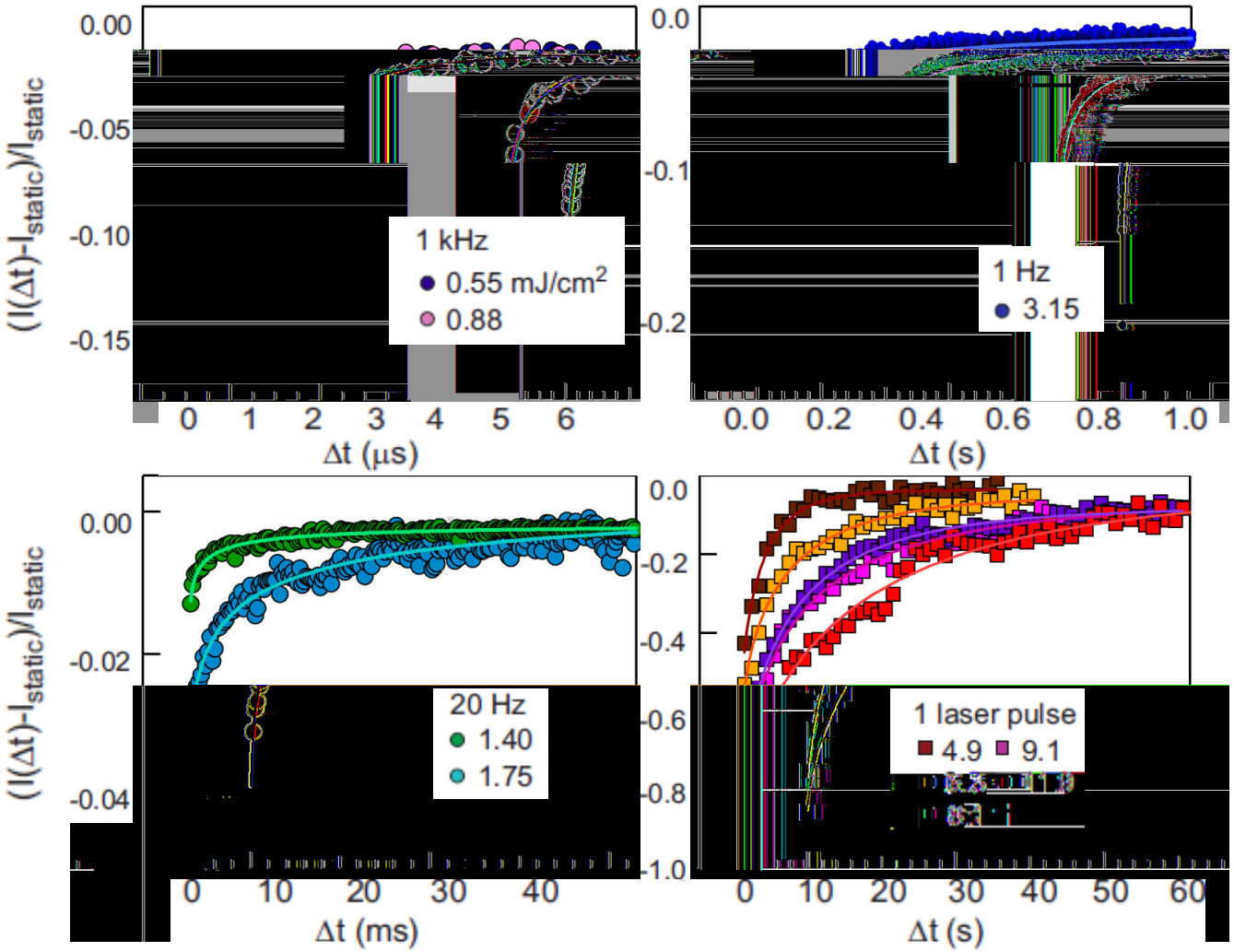
$$(\quad) = \quad ^{-(\quad / \quad)}$$

$$\beta = \quad /(\quad + 2)$$

[illegible]

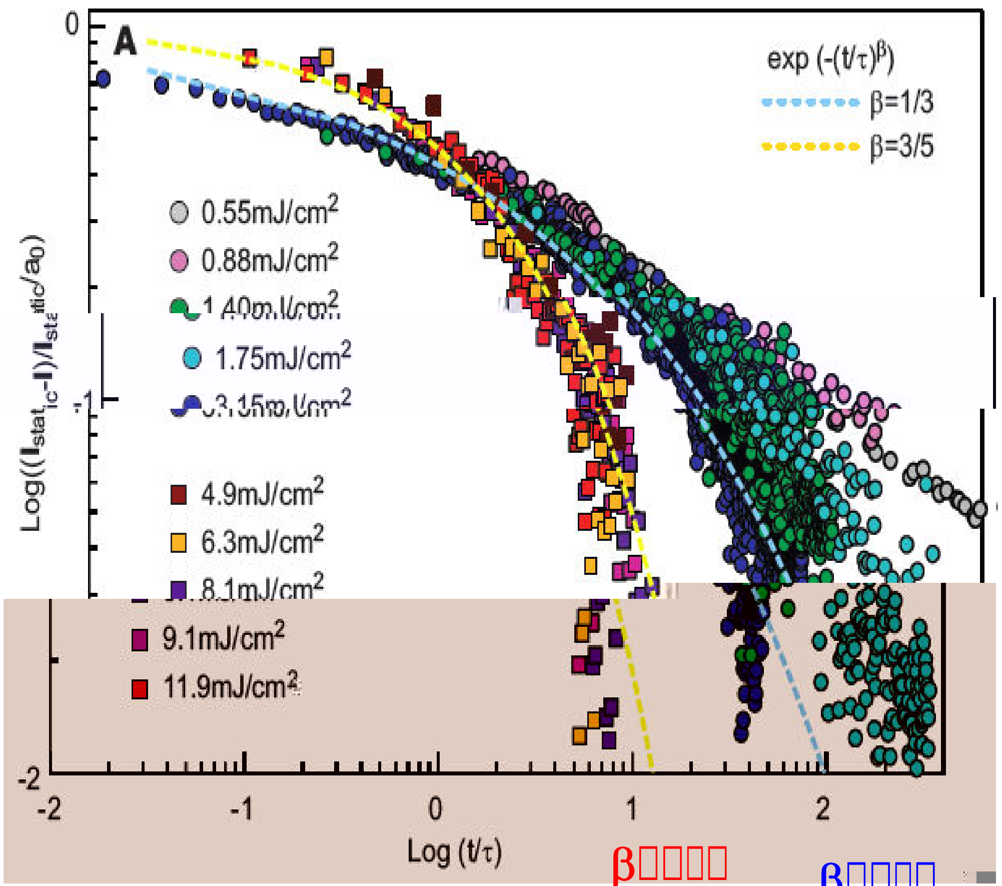
$$y = a_0 e^{-(t/\tau)^{\beta}}$$

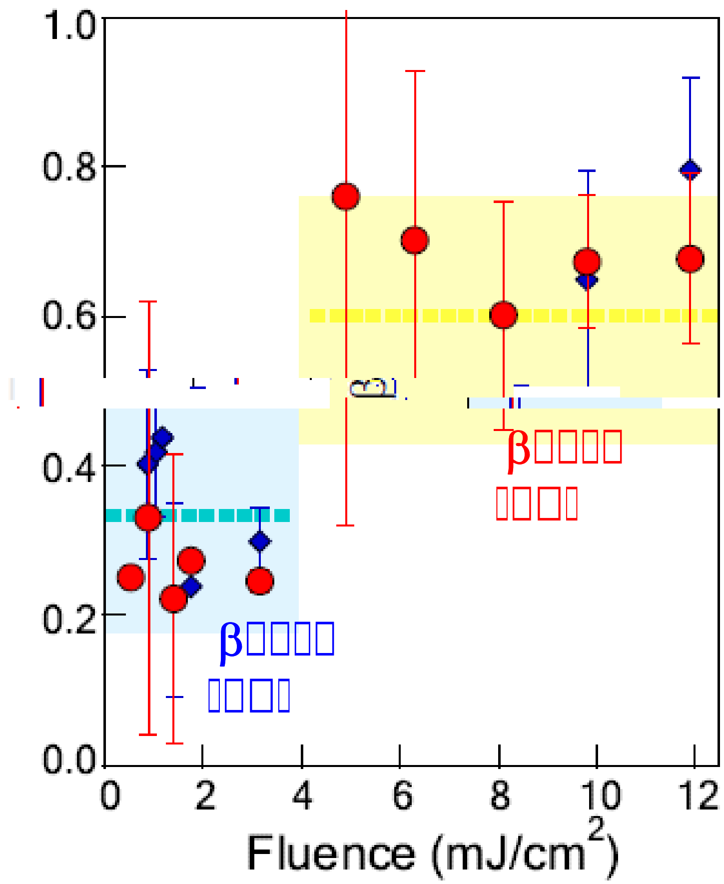
[illegible] τ, β)



[illegible]

$\beta = /(+2)$

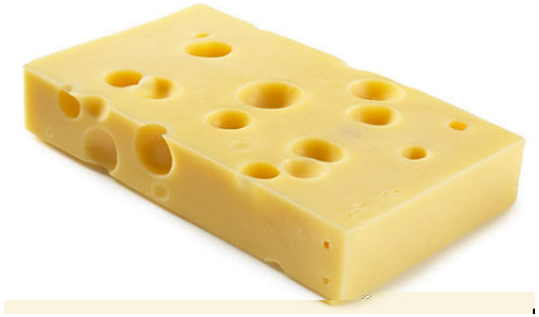

A
exp (-(t/τ)^β)
β=1/3
β=3/5
0.55mJ/cm²
0.88mJ/cm²
1.75mJ/cm²
4.9mJ/cm²
6.3mJ/cm²
9.1mJ/cm²
11.9mJ/cm²
Log (t/τ)


Fluence (mJ/cm²)

[illegible]

- [illegible]
  - [illegible]
  - [illegible]
- [illegible]
  - [illegible]
  - [illegible]

Laser-induced spin frustration



S.Y. Zhou arXiv: 1209.3452

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[

[illegible]

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(1) Melting dynamics

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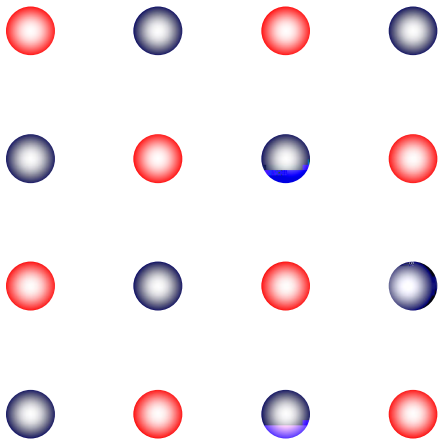
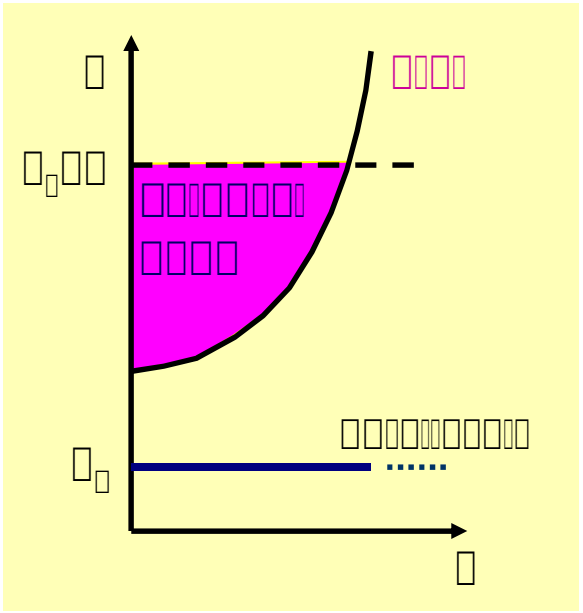
- **Perspectives on Time-resolved ARPES**

[illegible]

[illegible]

[illegible]





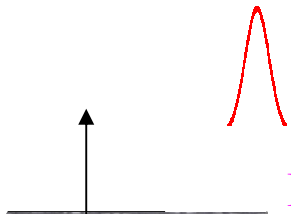
[illegible]

[illegible]

[illegible]

[illegible]

S.Y. Zhou ., Nature Mater **6**, 770 (2007)
S.Y. Zhou ., Nature Mater **7**, 259 (2008)
S.Y. Zhou ., Nature Phys **2**, 595 (2006)
S.Y. Zhou ., Phys. Rev. Lett **101**, 086402 (2008)


Probe
Pump t_0

[illegible]