INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

INTERNATIONAL CENTRE FOR SCIENCE AND HIGH TECHNOLOGY
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H4.SMR/676-31

SECOND SCHOOL ON THE USE OF SYNCHROTRON RADIATION IN SCIENCE AND TECHNOLOGY: *"JOHN FUGGLE MEMORIAL"*

25 October - 19 November 1993

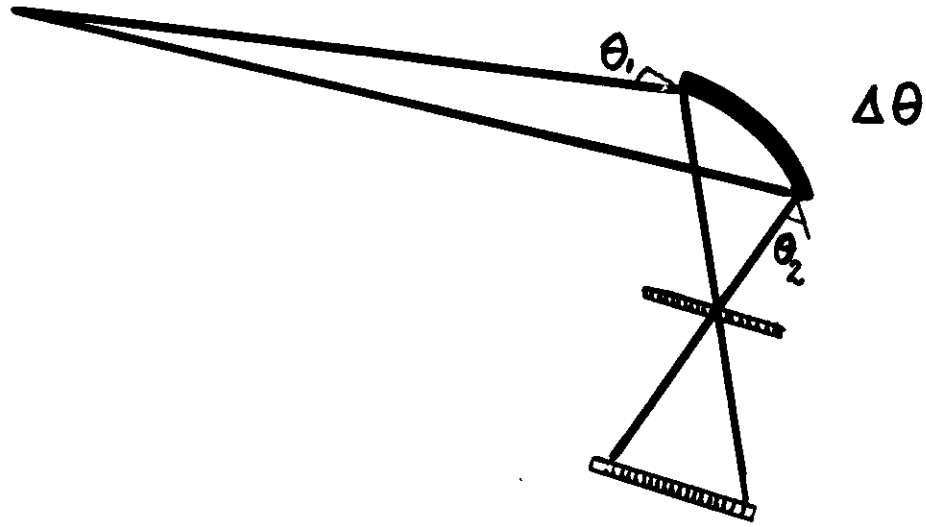
Miramare - Trieste, Italy

X-ray Instrumentation

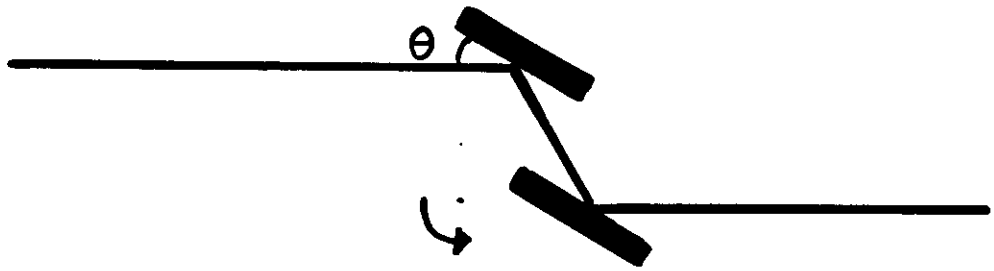
"High Resolution Flourescence Detection"

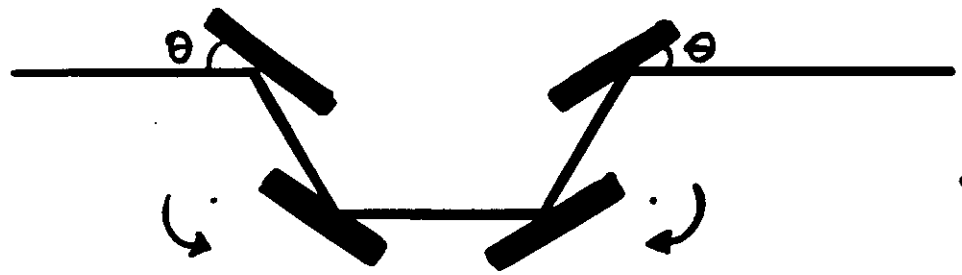
H. Tolentino
National Laboratory for Synchrotron Radiation
(LNLS)
Campinas, Brazil

1C



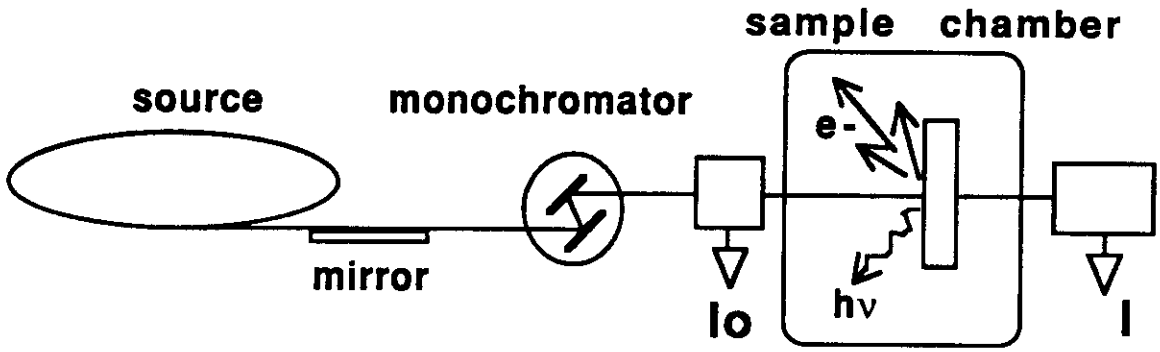
2C





4C

XAS workstation



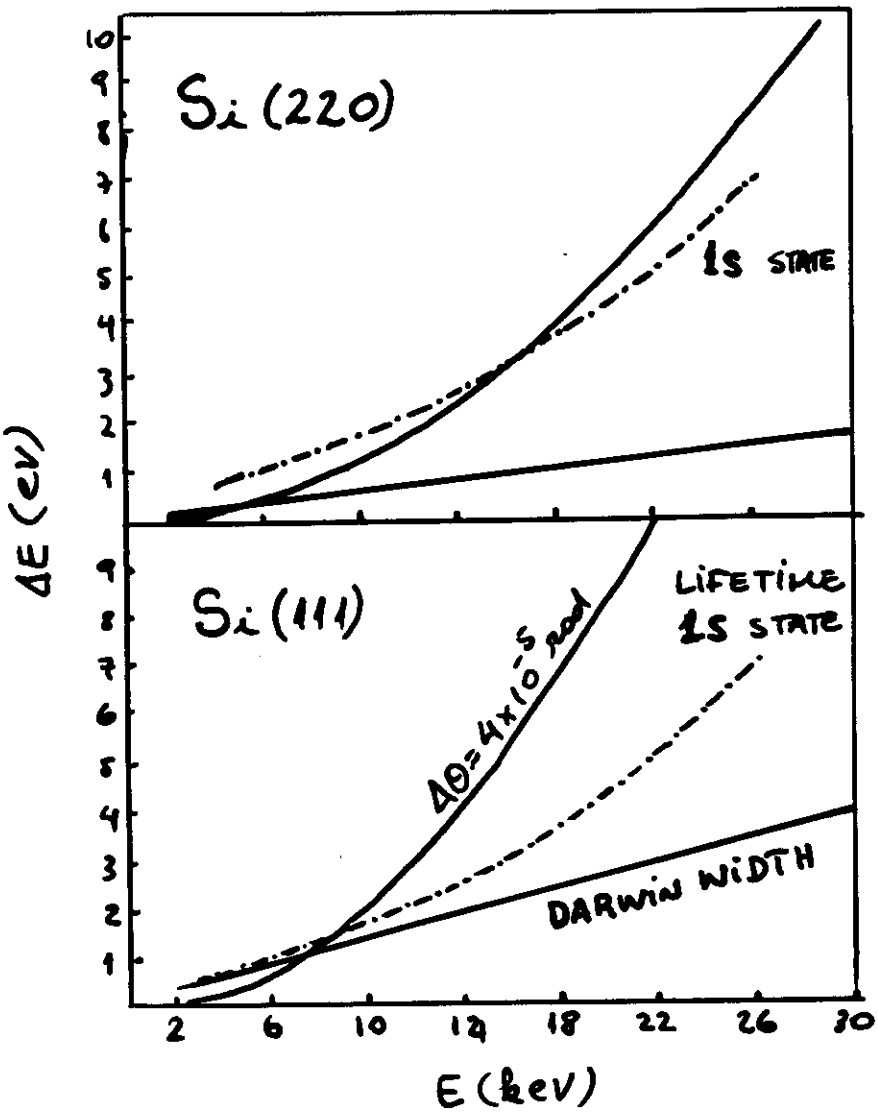
SR: "white beam"; → G C ; $\gamma^{-1} \sim 10^{-4}$ rad

MIRROR: filter "high energy cut-off"; focusing

Monochromator: small band-pass; scanning energy
geometrical and chromatic prop.

Detection: Io

TRANSMISSION	I
ELECTRON	e^-
FLUORESCENCE	hν



$2C \rightarrow 4C$

lifetime!

$\varepsilon = E_{h\nu} - E_K$

$\Delta\varepsilon \quad \Gamma_K$

KL-fluorescence

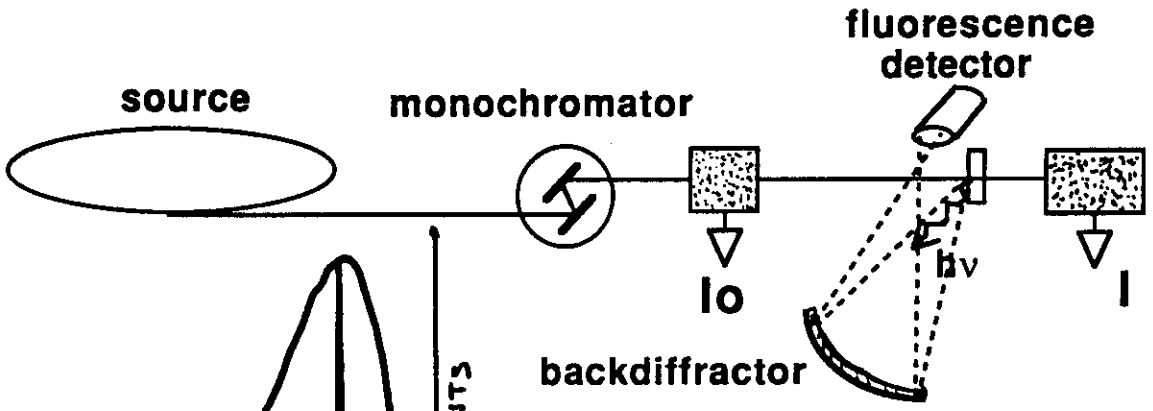
$\varepsilon = E_{h\nu} - E_F - E_L$

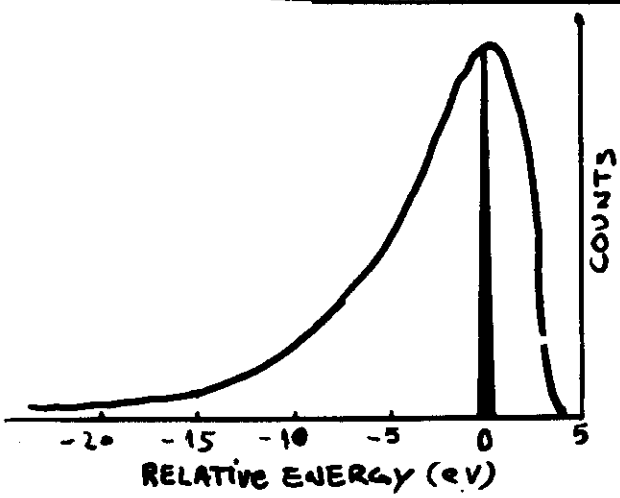
$\Delta\varepsilon \quad \sim \quad \Gamma_L$

$\not\Gamma_K$

XAS set up for

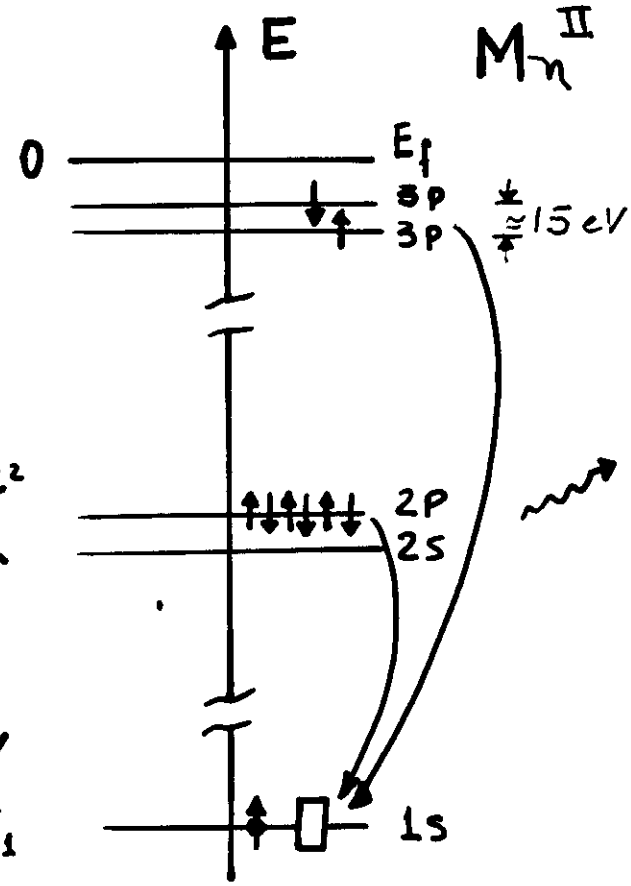
High Resolution Fluorescence Detection





K. HÄMÄLÄINEN et al.

PRL 67-20 (Nov 91)



$$\delta E = \sqrt{\delta E_1^2 + \delta E_2^2} \simeq \delta E_1$$

"Resolution"

ΔE

$$\delta E_{\#} = \sqrt{\Delta E^2 + \delta E_2^2}$$

K. HÄMÄLÄINEN
PRL 67-20 (1991)

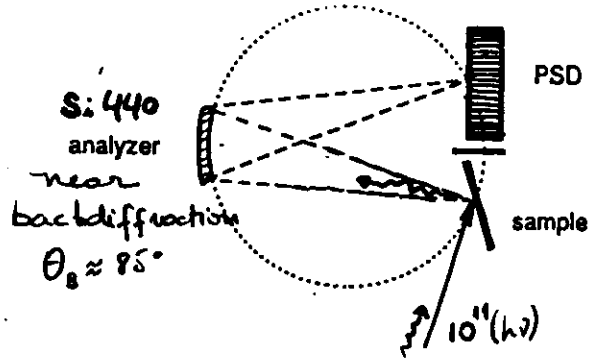
Dy:

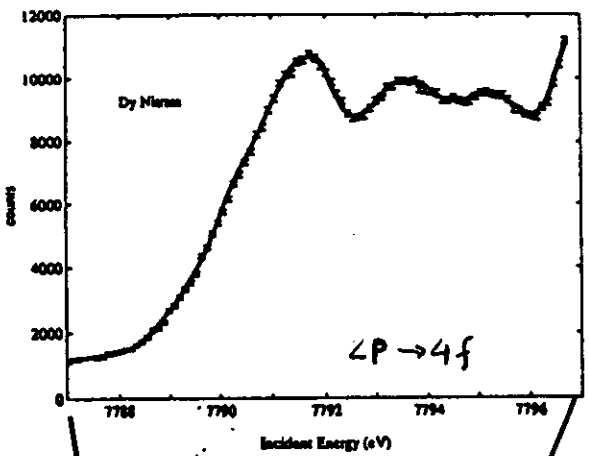
$\Gamma_{L_{III}} \approx 4.2\,eV$

$\Gamma_{M_V} \approx 1.4\,eV$

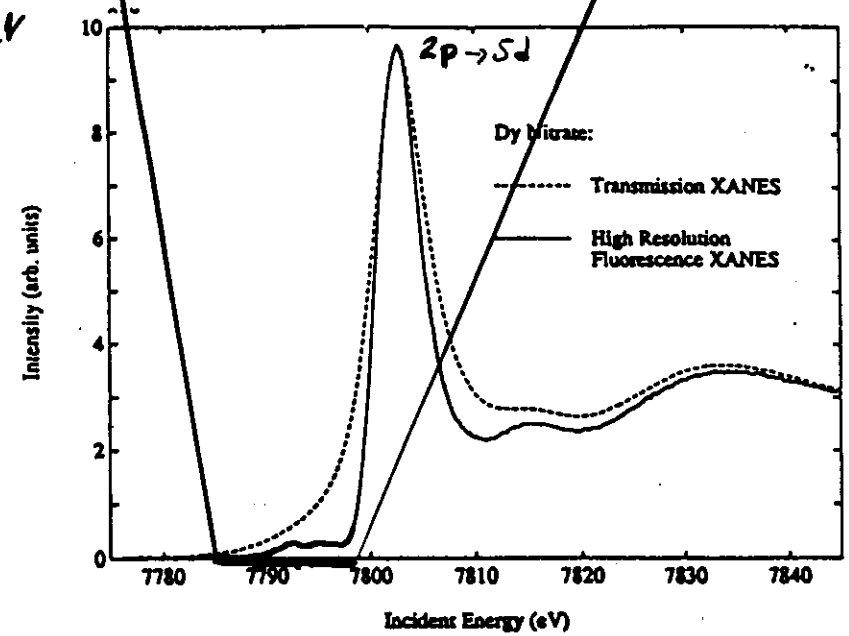
Si 440:
$\theta \approx 85°$
$\delta E \approx 0.3\,eV$ @ 6.5 keV

Si 220:
$\delta E \approx 0.7\,eV$ @ 6.5 keV
10^{11} ph/sec.

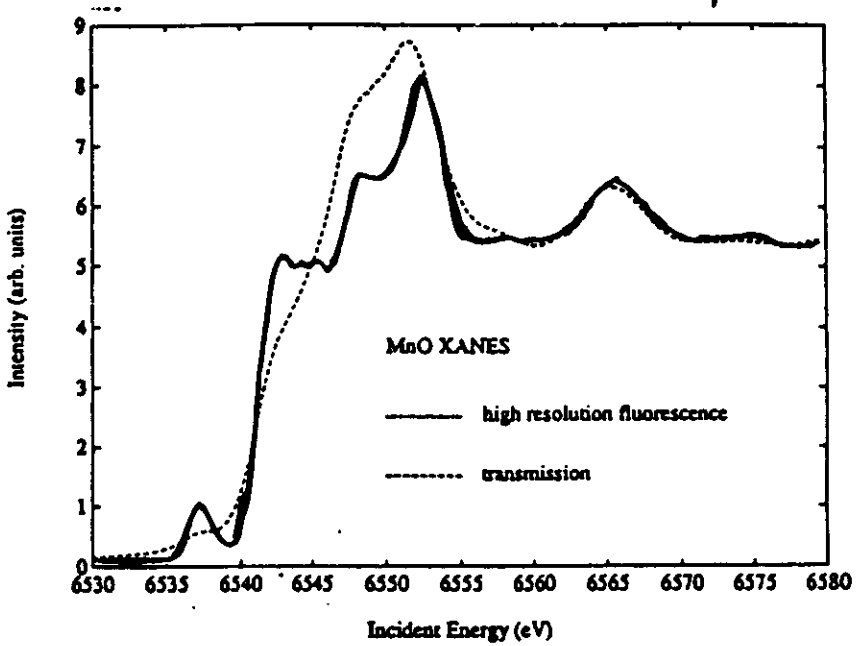


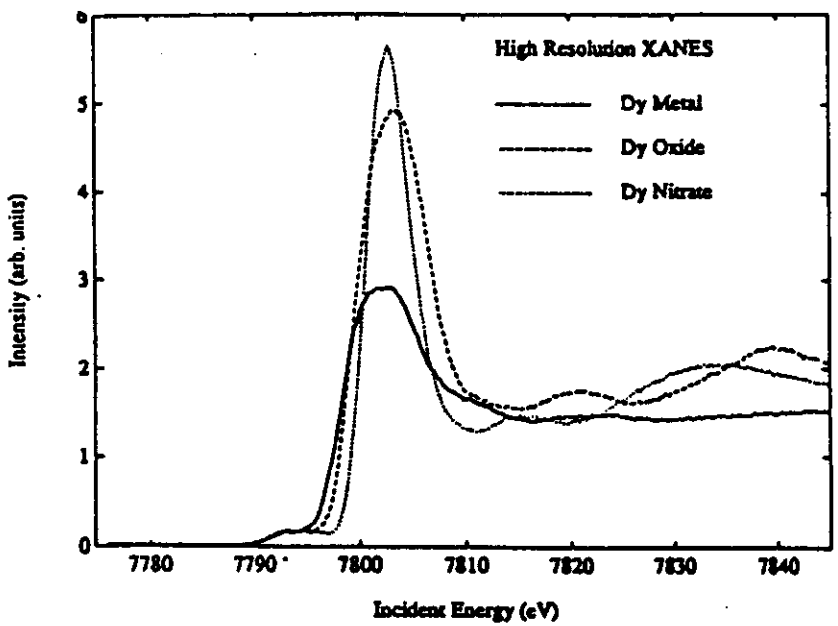


Dy: L_{III}



Mn





Theory of Dysprosium L_3 XANES Free from L_3 Core Lifetime Broadening

Satoshi TANAKA, Haruhiko OGASAWARA,* Kozo OKADA,† and Akio KOTANI†

Jpn. J. Appl. Phys. 32 (1993) Suppl. 32-2

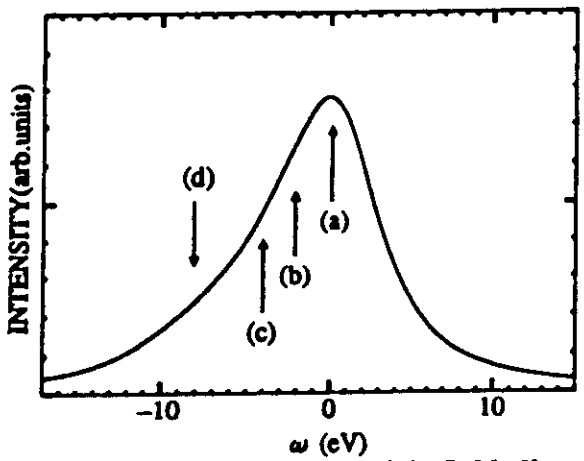
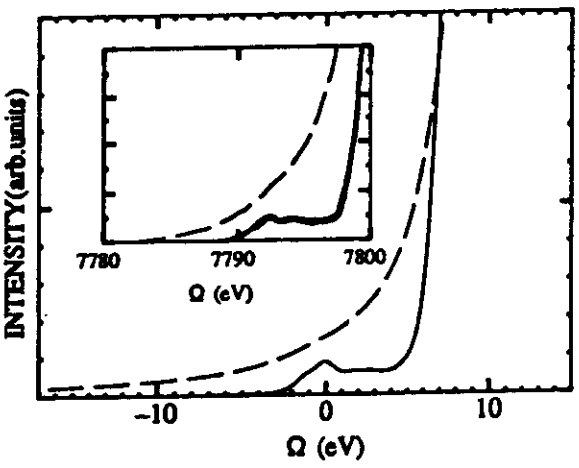


Figure 1: The calculated result of the L_3M_5 X-ray fluorescence spectrum.The excitation spectra in Fig.4 are obtained at the emitted photon energies denoted by the arrows (a) to (d).



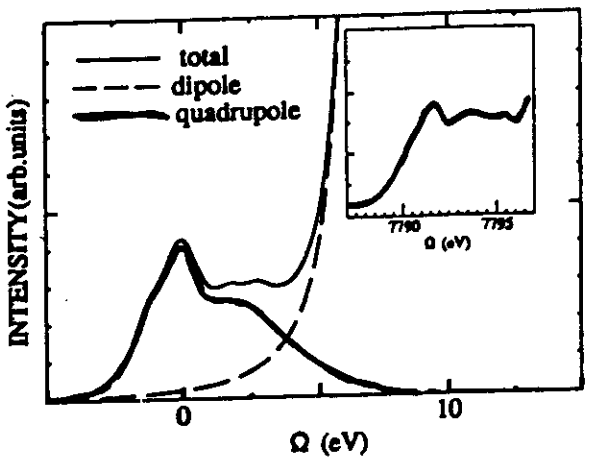
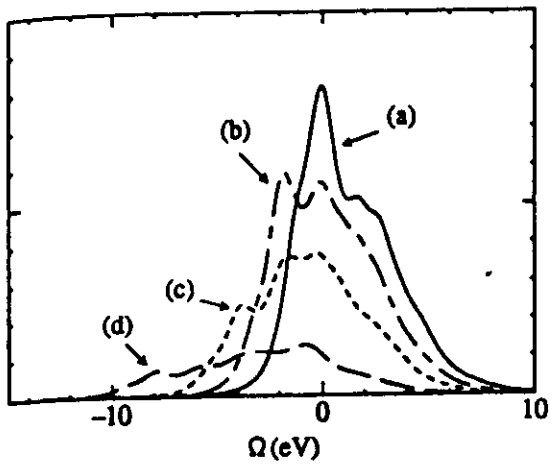
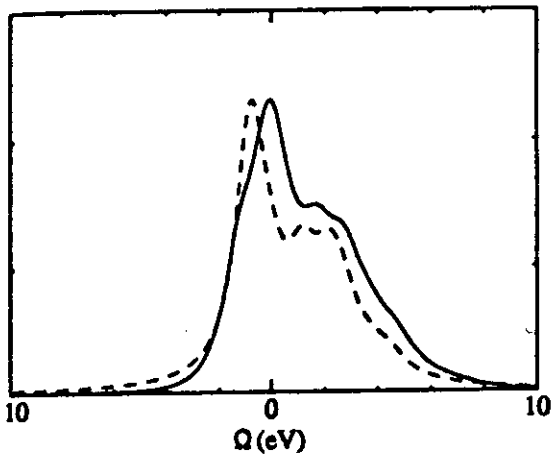


Figure 3: The calculated results of the fine structure of the excitation spectrum in the L_3-edge region. Both of the contributions from the $2p \rightarrow 5d$ dipole transition (broken line) and the [illegible] quadrupole transitions

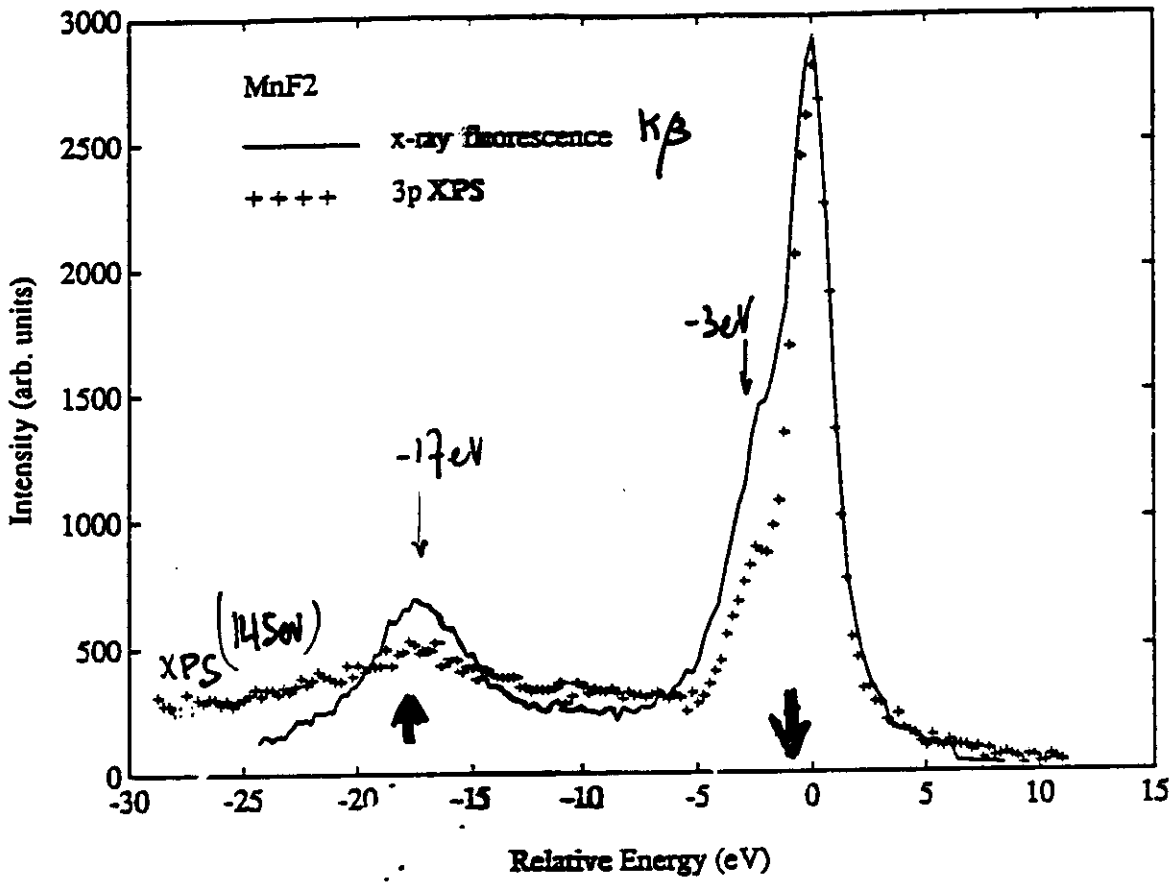


ure 4: The change of the excitation spectrum with change of the emitted photon energy, where only the $\rightarrow 5d$ quadrupole transition is taken into account. e emitted photon energies are tuned at (a)0eV(solid), (b)−2eV(chain line), (c)−4eV(dotted line) and −8eV(broken line) as shown by the arrows in Fig.1



ure 5: The calculated results of the excitation spec- n(solid line) and the absorption spectrum with the th Γ_M(0.7eV)(broken line), where only the $2p \rightarrow 4f$ drupole transition is taken into account.

3p → 1s



3d ↑↑↑↑↑

3p ↑ □

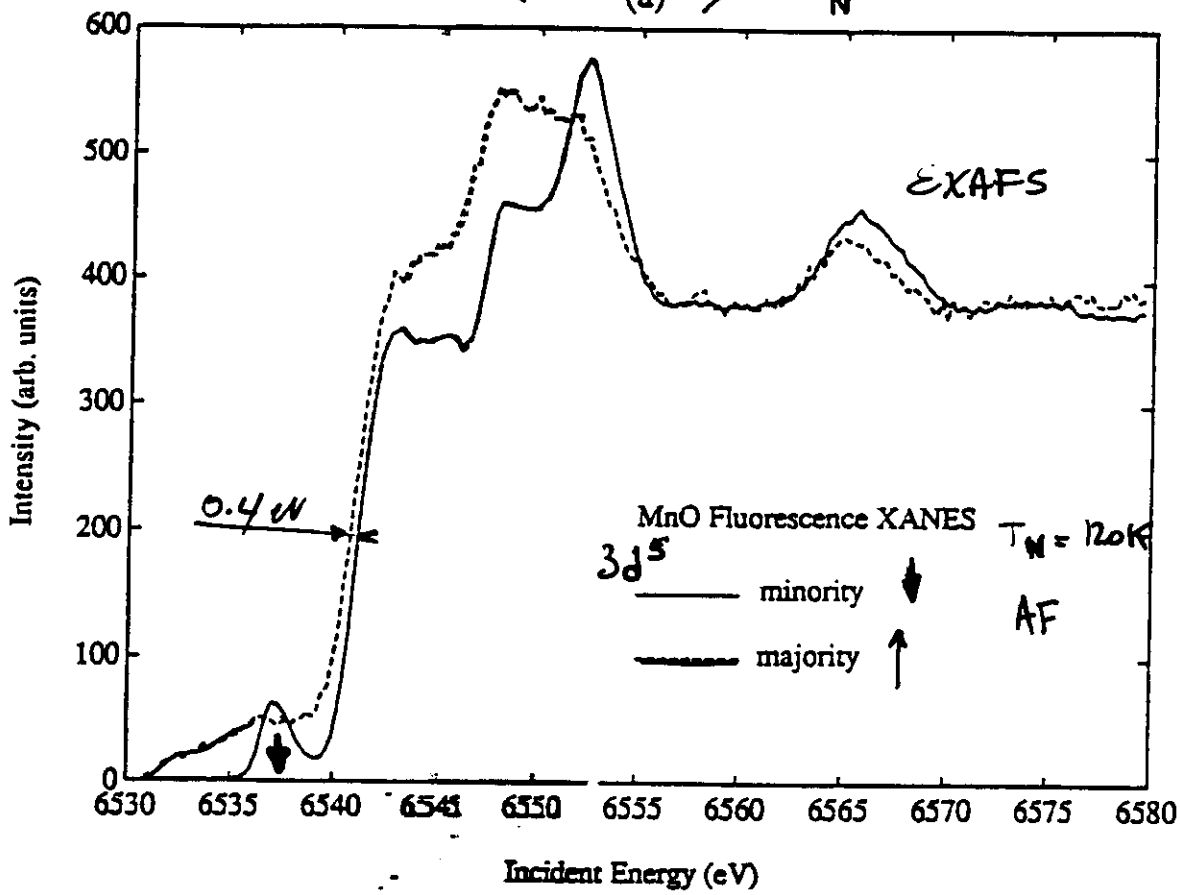
3p hole (-52.7eV)

↑↑↑↓ ↑↑↑↑↑

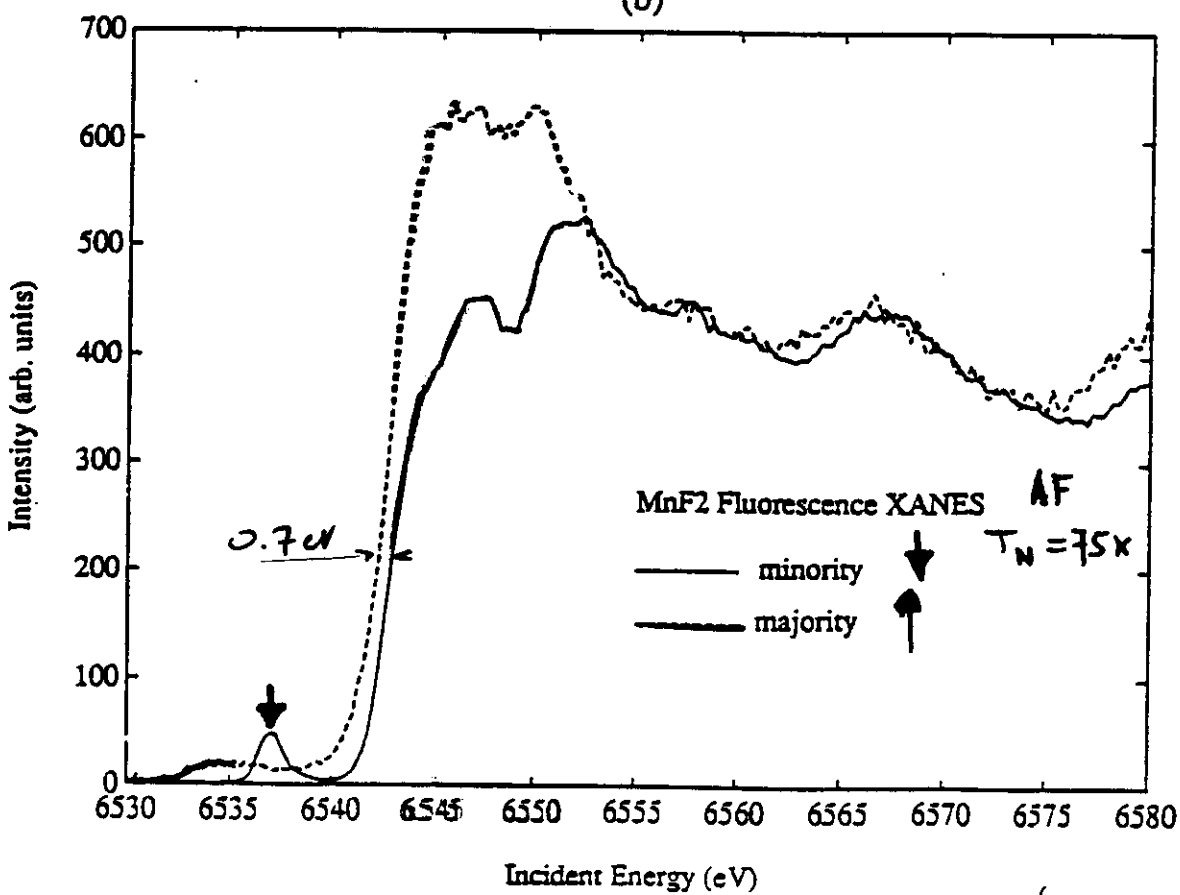
□↑ □↓

FIG. 2.

R.T. (a) $> T_N$



(b)



MnO / MnF_2 1.5 eV (ligand field)

DISCUSSION :

2C & 4C SCANNING MONOCHROMATOR

FLUX ↔ RESOLUTION

DETECTION OF DECAY PROCESSES

e^-

$h\nu$

Γ

HIGH RESOLUTION $h\nu$

CORE HOLE LIFETIME ~~Γ~~

NEW POSSIBILITIES :

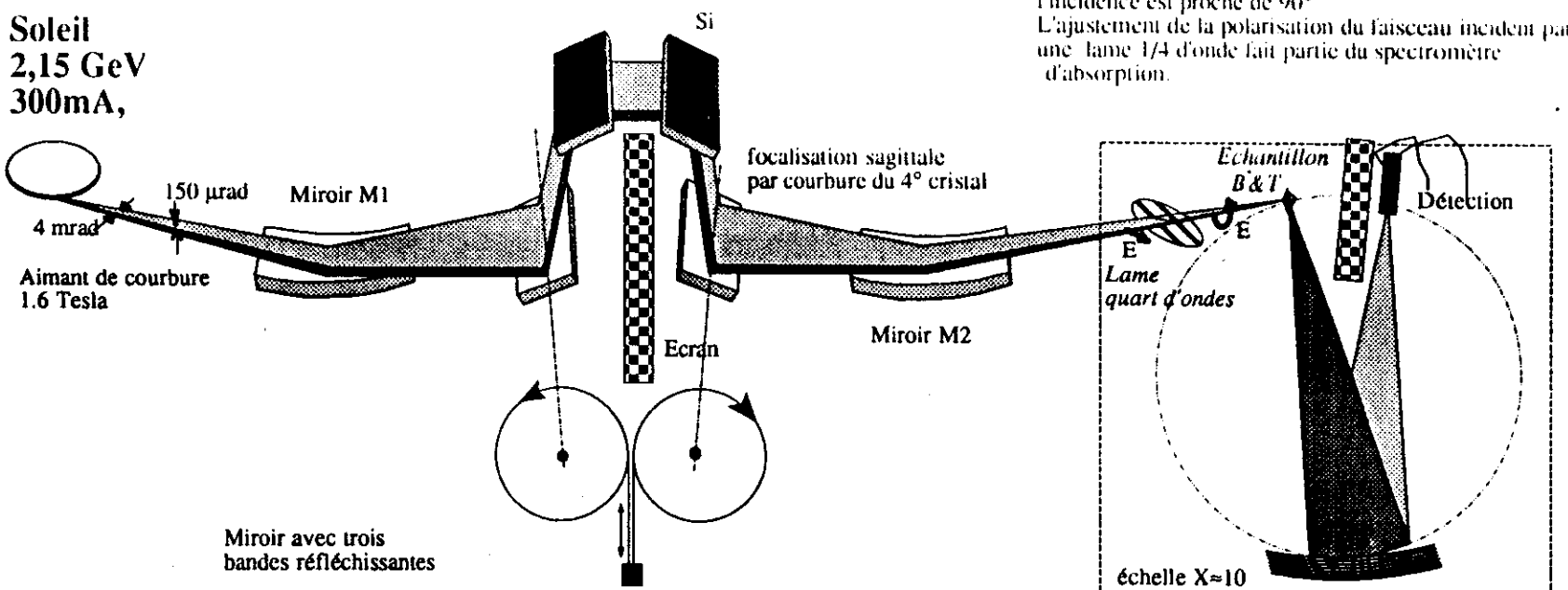
IMPROVED RESOLUTION

SPIN RESOLVED

but, EXTREMELY HIGH FLUX

Schéma optique pour un Spectromètre d'absorption X haute résolution:

Analyse par un cristal de Bragg du rayonnement émis par l'échantillon qui est source de rayonnement secondaire. Le cristal courbe et le détecteur sont sur le cercle de Rowland.Une analyse en énergie à très haute résolution est assurée par cette géométrie où l'incidence est proche de 90°
L'ajustement de la polarisation du faisceau incident par une lame 1/4 d'onde fait partie du spectromètre d'absorption.



Exemple de la fluorescence K résolue en spin des éléments magnétiques de la première série des métaux de transition excités par un faisceau X de polarisation ajustable