the Swiss-Danish Instrument Initiative presents

Estia

a focusing reflectometer for small samples based on the Selene guide concept

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Science Case

Depth-profiling of structural and magnetic densities

Lateral structures close to surfaces

Organic films at a solid liquid interface

Laterally structured (organic) films

Functional devices

Magnetic heterostructures
instrument

key parameters

sample size $1 \times 1 \text{ mm}^2$ to $10 \times 50 \text{ mm}^2$

horizontal scattering plane

intrinsic resolution 2 to 4%

polarisation option

low background

truly focusing
point-to-point focusing with 2 subsequent elliptical reflectors for horizontal- and vertical direction

Selene guide concept
instrument

shielding concept

direct view: 14 m
indirect view: 26 m

time regime

\[ \lambda \in [5, 9.4] \text{ Å} \]

\[ \Delta \theta_{xy} = 1.5^\circ \]
\[ \Delta \theta_{xz} = 1.5^\circ \]
operation modes

almost conventional

convergent beam

defined footprint

defined divergence

medium resolution (≈ 5%)

specular & off-specular reflectometry
operation modes

almost conventional

convergent beam

defined footprint

defined divergence

medium resolution (≈ 5%)

liquid interfaces

e.g. solid-liquid cell

avoid gasket & trough walls

restrict to a homogeneous area
operation modes

almost conventional

convergent beam

defined footprint

defined divergence

medium resolution ($\approx 5\%$)

specular & off-specular reflectometry

multiferroics

strain induced FM in multiferroic AFM LuMnO$_3$

J. White et al.

PRL 111, 037201 (2013)
operation modes

high-intensity specular reflectivity

trading off-specular resolution for intensity
⇒ complex resolution function

quick & dirty way to scan a phase diagram

time-resolved studies

tiny samples
operation modes

high-intensity specular

trading off-specular resolution

⇒ complex resolution

tiny samples

novel electronic phases at interfaces

exchange bias in LaNiO$_3$ (PM) / LaMnO$_3$ (FM) superlattices

M. Gibert et al.
nature materials 11, 195198 (2012)
operation modes

high-intensity specular reflectivity

trading off-specular resolution

⇒ complex resolution function

quick & dirty way to scan a phase diagram

time-resolved studies

tiny samples

interdiffusion

Li diffusion through a thin Si layer

E. Huger at al.

Nano Lett. 13, 1237 (2013)
**operation modes**

- **λ-θ encoding**
  - $\lambda \propto \alpha$
  - multilayer

- **spectral analysis of the white beam**

- **constant $\Delta q/q$**

- **wide $q_z$-range**
operation modes

\[ \lambda - \theta \text{ encoding} \]

functional devices

electrical switching of spin polarisation
D. Pantel et al. nature materials 11, 289 (2012)

active area < 50 \times 50 \mu m^2

constant \( \Delta q/q \)

wide \( q_z \)-range
operation modes

parallel beam

by reflection on a parabolic mirror

tunable divergence and beam size

uni-modal beam characteristics

for laterally structured samples (GISANS)

constant angle of incidence

low-\(m\) coating \(\Rightarrow\) high \(P\)
**operation modes**

parallel beam

by reflection on a *parabolic* mirror

tunable divergence and uni-modal beam characteristics

**structured surfaces**

nanostructured diblock copolymer films with embedded magnetic nanoparticles

*Xin Xia et al. J. Phys. 23, 254203 (2011)*

for *laterally structured samples* (GISANS)

**polarisation**

by selective reflection

constant angle of incidence

low-$m$ coating $\Rightarrow$ high $P$
performance

obtained by McStas simulations

λ-θ encoding

high-intensity specular reflectivity

almost conventional

1000 Å Ni on glass (5 × 5 mm²)

reflectivity log₁₀ R(qz)

$qz / \text{Å}^{-1}$

$t / s$

60

900

1

10

100

60

900

1

10

100
Estia

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