17TH ADVANCED BEAM DYNAMICS WORKSHOP ON

FUTURE LIGHT SOURCES

Some Viewgraphs on X-ray Optics

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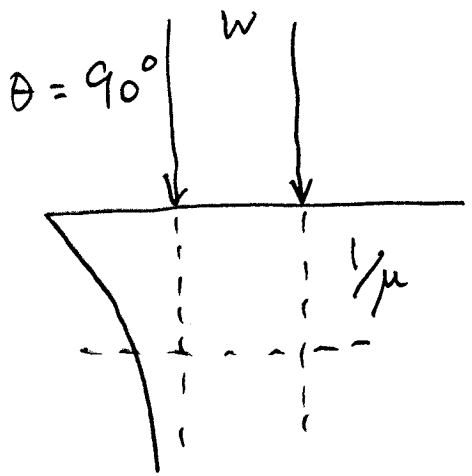
THE GRAZING INCIDENCE ADVANTAGE

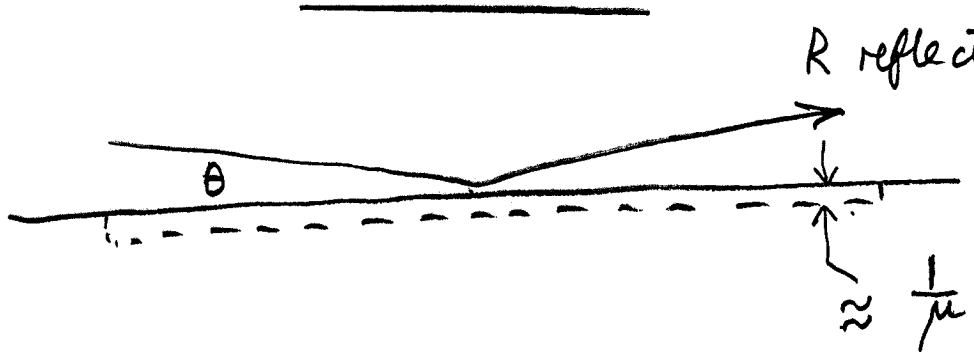
NORMAL



$$\text{Dose} = \frac{F}{w^2 \frac{1}{\mu}} \cdot \text{energy/vol}$$

no reflection

GRAZING



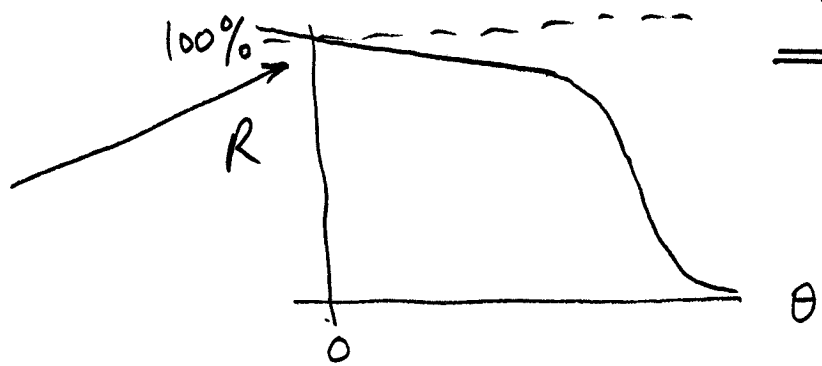
$(\theta \text{ small}, \ \beta \ll \delta)$

$$\text{Dose} = \frac{F}{w \cdot \frac{w}{\theta} \cdot \frac{1}{\mu} \frac{\beta}{\theta_c}} (1 - R)$$

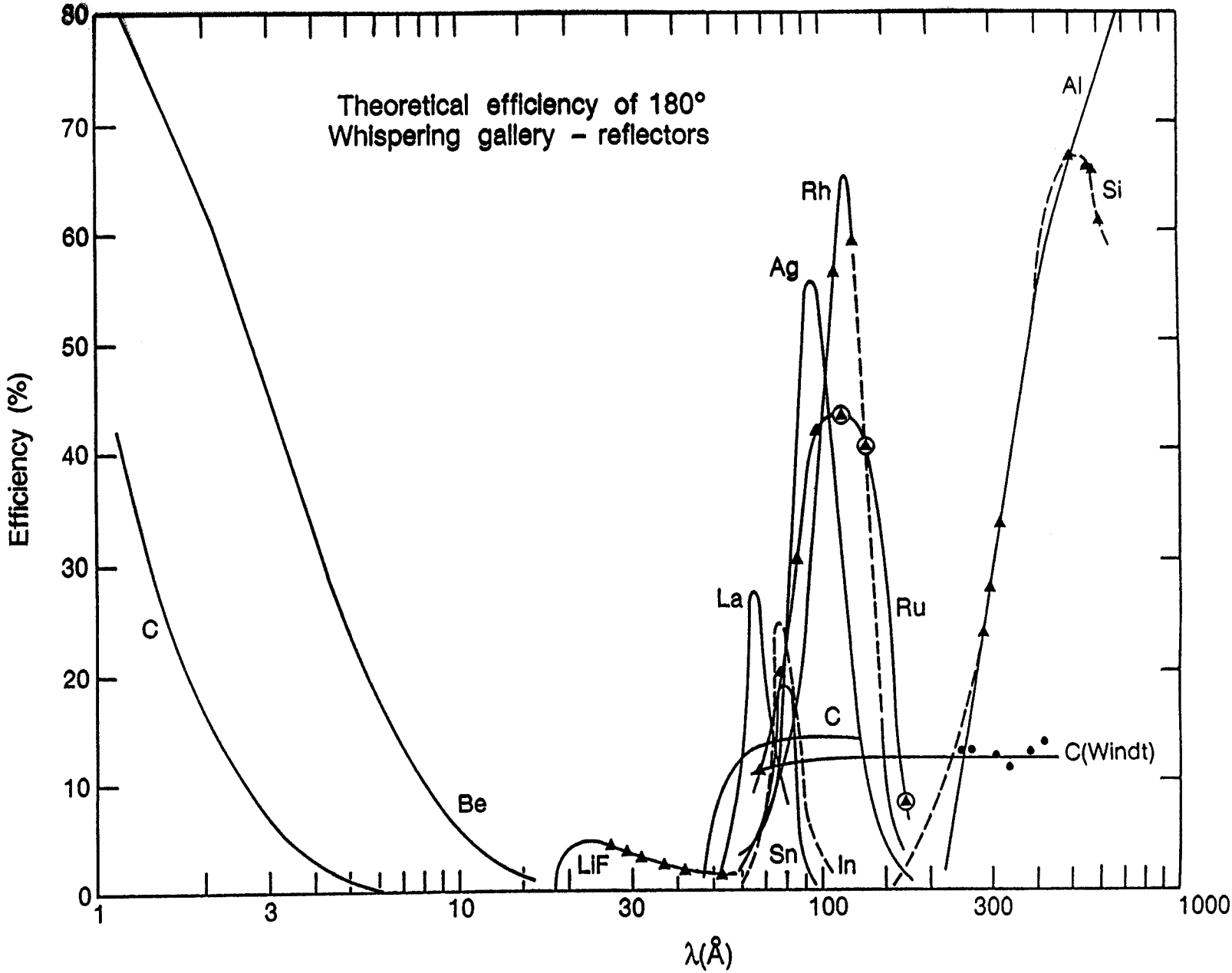
$$= (\text{Dose})_{NI} \frac{\theta \theta_c}{\beta} \frac{2\theta}{\theta_c} \frac{\beta}{\delta} =$$

$$= (\text{Dose})_{NI} \frac{4\theta^2}{\theta_c^2}$$

$$R \approx 1 - \frac{2\theta}{\theta_c} \frac{\beta}{\delta}$$



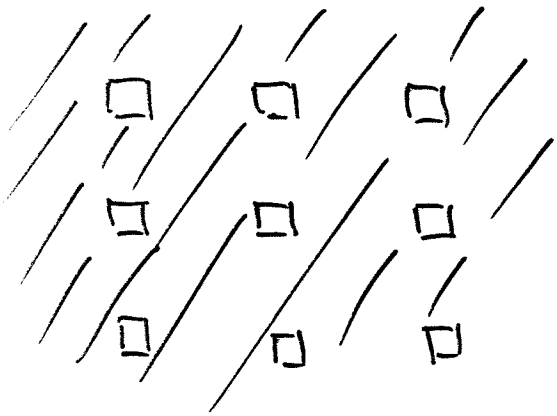
$(< \theta !)$


Theoretical efficiency of 180°
Whispering gallery – reflectors
Efficiency (%)
λ(Å)
80
70
60
50
40
30
20
10
0
1
3
10
30
100
300
1000
C
Be
LiF
Sn
In
La
Rh
Ag
Ru
C
Al
Si
C(Windt)

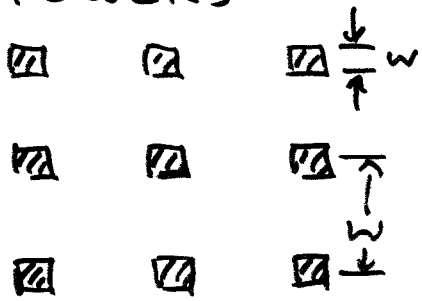
XBL 912-6019

BEAM SPLITTERS FOR ONE-SHOT TOMOGRAPH

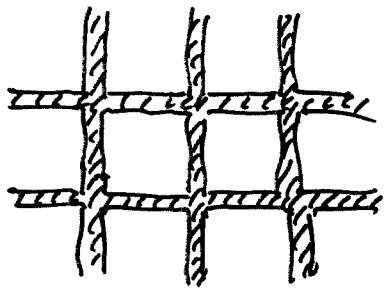
HOLES



π PHASE SHIFTING TOWERS



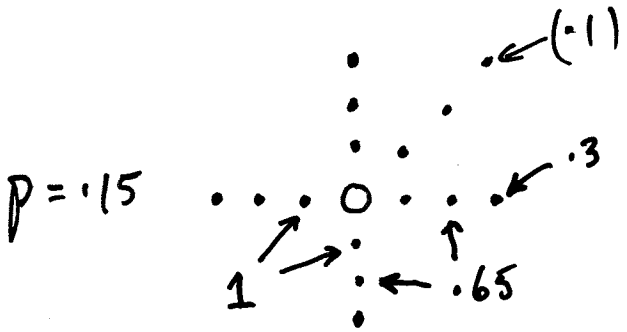
CRISS-CROSS π SHIFTERS



$\frac{w}{W} = p$

TRANSMISSION

	0,0	0,n	total	0,0 for p = .2
Holes	p^4	$p^4 \operatorname{sinc}^2 np$	p^2	.0016
π Towers or its complement	$(1-2p^2)^2$	$4p^4 \operatorname{sinc}^2 np$	1	.85
criss cross	$(2(1-p)^2-1)^2$	$4p^2(1-p^2) \operatorname{sinc}^2 np$	1	.078



$W = 100\,\text{Å}$

$W = 500\,\text{Å}$

$\lambda = 30\,\text{Å}$

$NA = \frac{1}{20}$

Diffraction-limited resolution = 300Å

Angle = > 30°

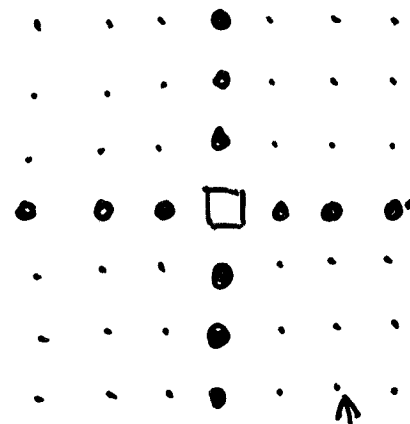
STRENGTH OF ORDERS

Principles:

Babinet's principle:

Complementary screens have the same diffraction pattern outside the incident beam

$$\left|(1-p)\,\mathrm{sinc}\,m(1-p)\right|^2 \equiv \left|p\,\mathrm{sinc}\,mp\right|^2 \quad (m \neq 0)$$



$|c_{10}|^2$, $|c_{20}|^2$ etc much stronger for walls & ditches

$m \neq 0$ } equally weak for
$n \neq 0$ } all four types

π phase shifters always 4 times more efficient