CHARACTERIZATION OF THE SR POLARIZATION STATE AT SPEAR3

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Abstract

The polarization state of synchrotron radiation can be characterized as a function of vertical observation angle and compared with theory.

Schwinger’s equations provide the theory for the SR angular- and spectrum distribution.

With a polarizer, QWP and power meter driven by an automated system the Stokes parameters were measured and beam polarization ellipse evaluated.

Agreement between measurement and theory is good when the effect of a reflective metal mirror is taken into account.

Visible light diagnostic beamline

Unfocused SR

Beam coherence measurements

SR line end-station

Si substrate

Al mirror

SR Beam

81°

3.25°

6.25°

Rhodium pickoff mirror (81° incidence angle)

S- and P-wave reflection at mirror

Wavelength (nm)

Intensities Characterize Polarization State

Stokes parameters

$S_0 = E_0^x + E_0^y = I_{00} - I_{135}$

$S_1 = E_0^x - E_0^y = I_{00} - I_{90}$

$S_2 = 2E_0^x E_0^y \cos(\delta) = I_{45} - I_{135}$

$S_3 = 2E_0^x E_0^y \sin(\delta) = I_{45}^\text{PWP} - I_{135}^\text{QWP}$

$\delta$ is the relative phase between $E_x$ and $E_y$

Images:

- Beam polarization measurements at 532nm
- SR emission and reflection at pick-off mirror

Summary

- Unfocused SR in diagnostic beam line
- Measured the SR beam polarization state
- Field attenuation and phase shift at Rh mirror
- Compare with SR theory – agreement is good
- Calculate Stokes parameters
- Calculate polarization ellipse