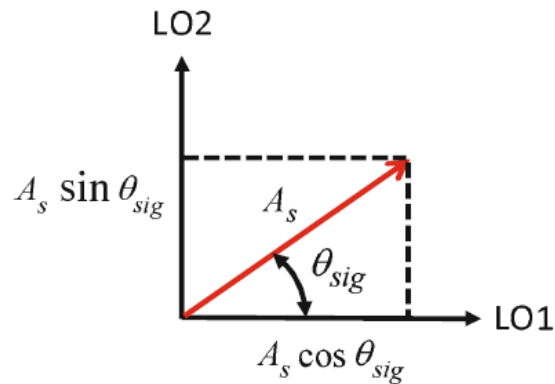


# Coherent Detection - Homodyne Receiver

$$\omega_s = \omega_{LO} \Rightarrow |\omega_s - \omega_{LO}| = 0$$

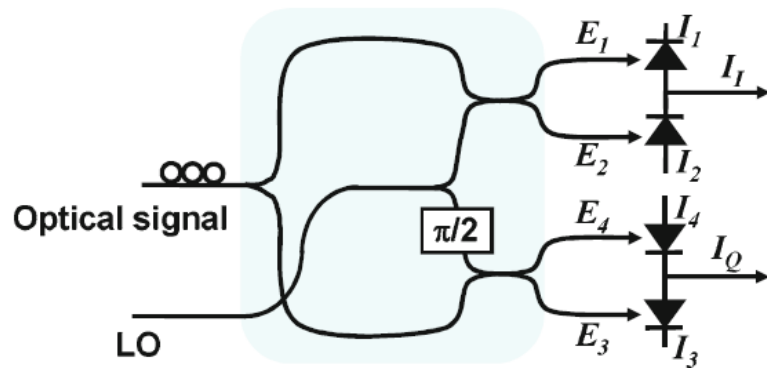


$$E_1 = \frac{1}{\sqrt{2}} (E_S + E_{LO})$$

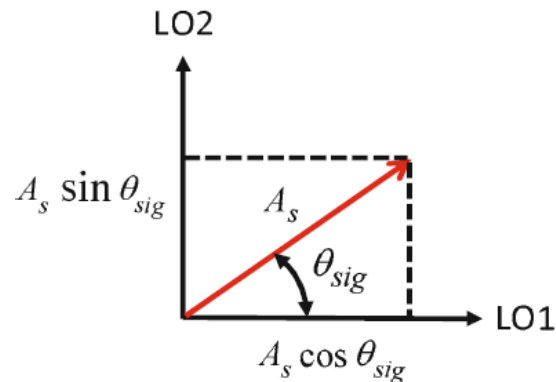
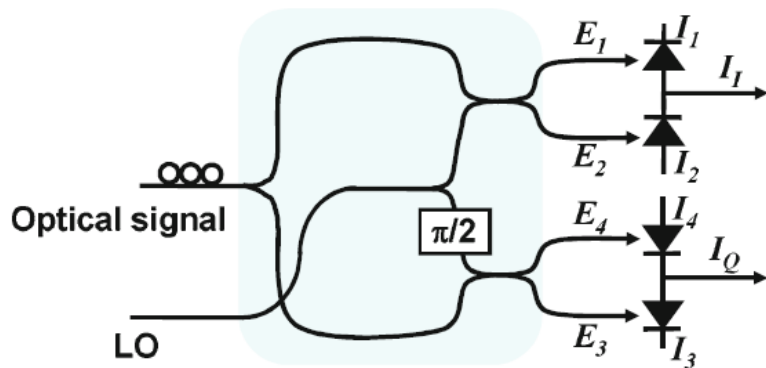
$$E_2 = \frac{1}{\sqrt{2}} (E_S - E_{LO})$$

$$E_3 = \frac{1}{\sqrt{2}} (E_S + jE_{LO})$$

$$E_4 = \frac{1}{\sqrt{2}} (E_S - jE_{LO})$$



# Coherent Detection – Homodyne Receiver



Current from Signal In Phase  
with Local Oscillator

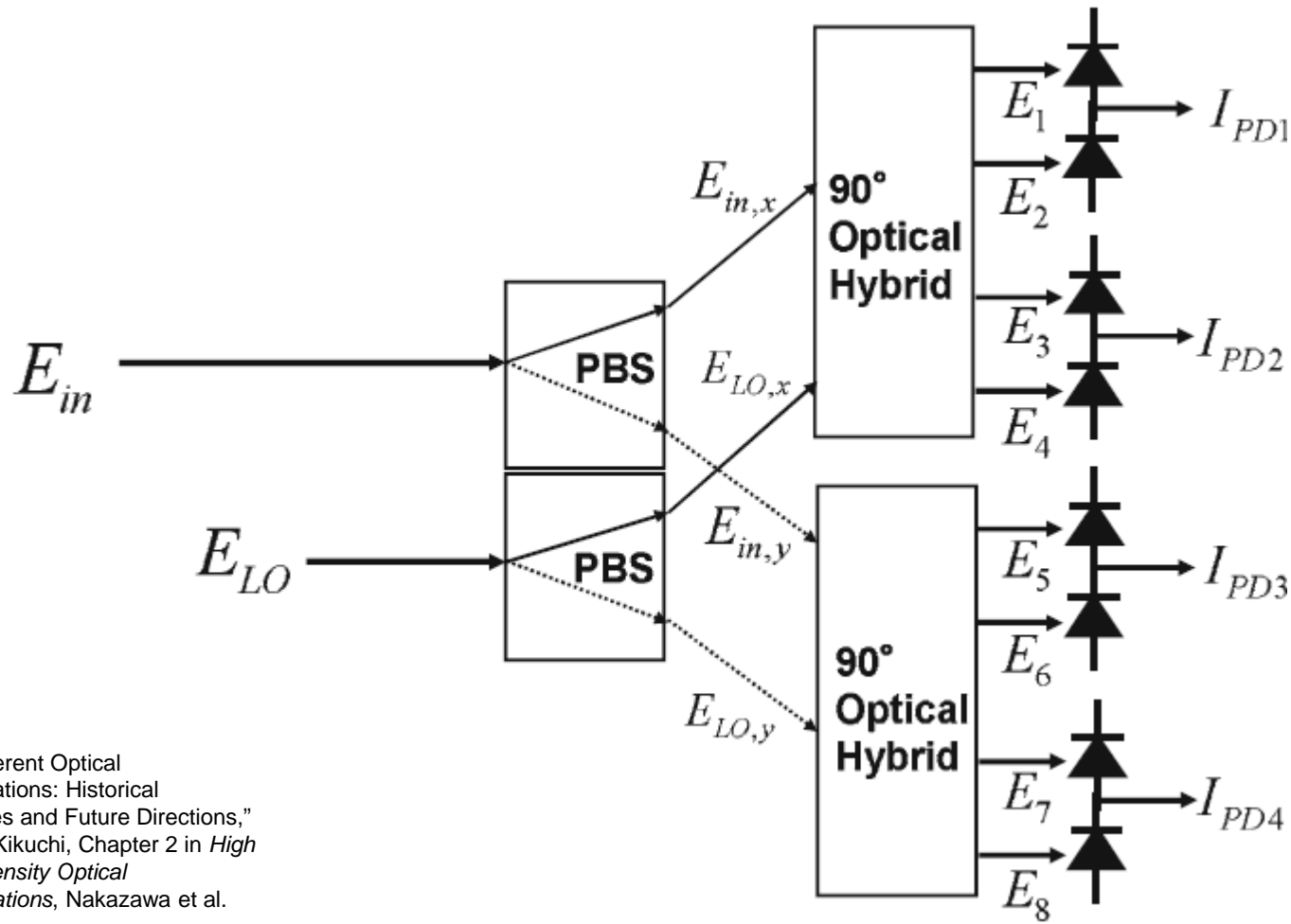
$$I_I(t) = I_{I1}(t) - I_{I2}(t) = R\sqrt{P_s P_{LO}} \cos\{\theta_{sig}(t) - \theta_{LO}(t)\}$$

$$I_Q(t) = I_{Q1}(t) - I_{Q2}(t) = R\sqrt{P_s P_{LO}} \sin\{\theta_{sig}(t) - \theta_{LO}(t)\}$$

Quadrature Current from Signal  $\pi/2$   
Out of Phase with Local Oscillator

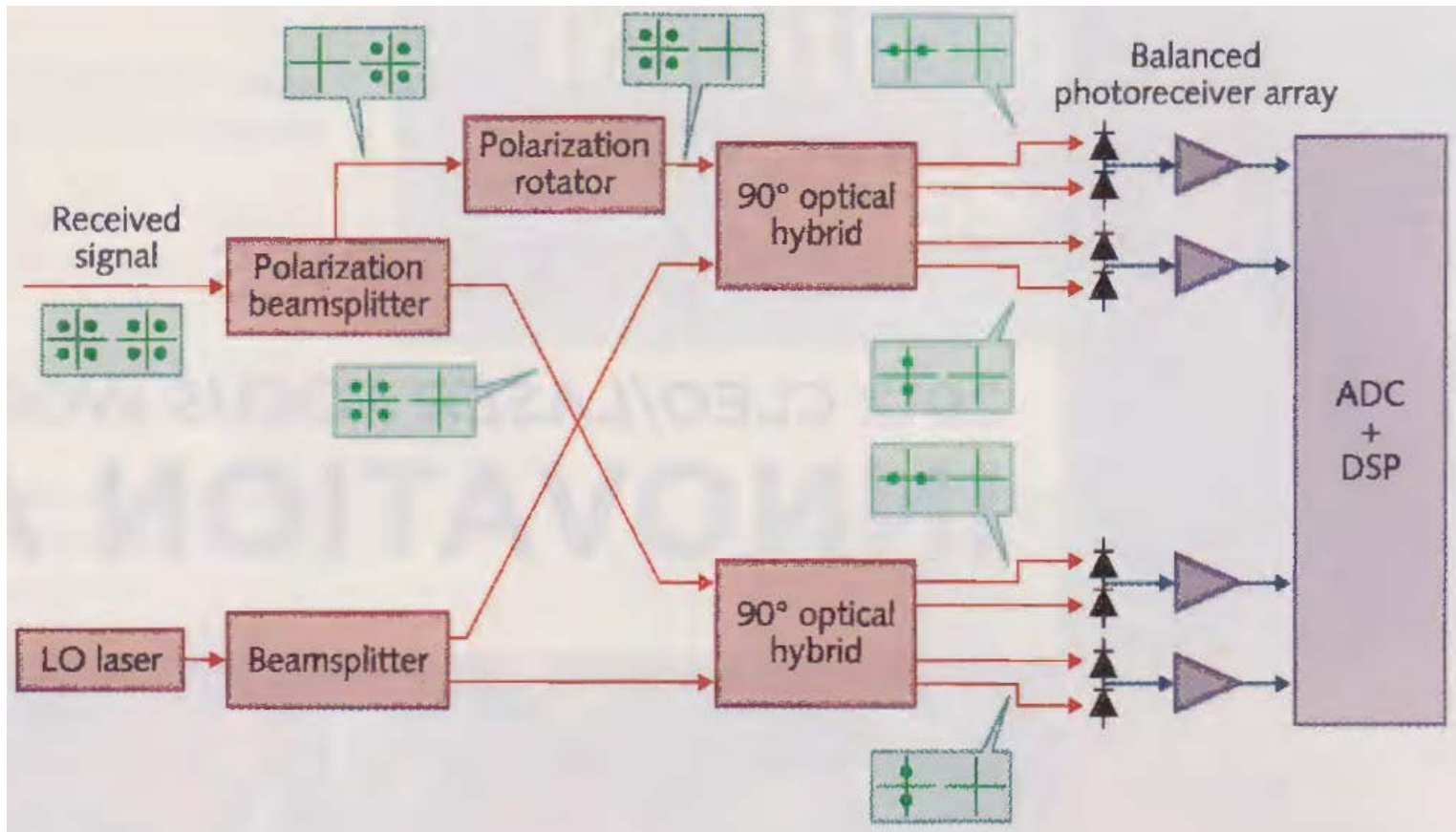
From "Coherent Optical Communications: Historical Perspectives and Future Directions," by Kazuro Kikuchi, Chapter 2 in *High Spectral Density Optical Communications*, Nakazawa et al. editors.

# Coherent Detection – Homodyne Receiver with Phase and Polarization Diversity



From "Coherent Optical Communications: Historical Perspectives and Future Directions," by Kazuro Kikuchi, Chapter 2 in *High Spectral Density Optical Communications*, Nakazawa et al. editors.

# DP-QPSK Optical Receiver



From "Multilevel Modulation Formats Push Capacities Beyond 100 Gbit/s," Joshi et al., Laser Focus World, February 2012, p 5863