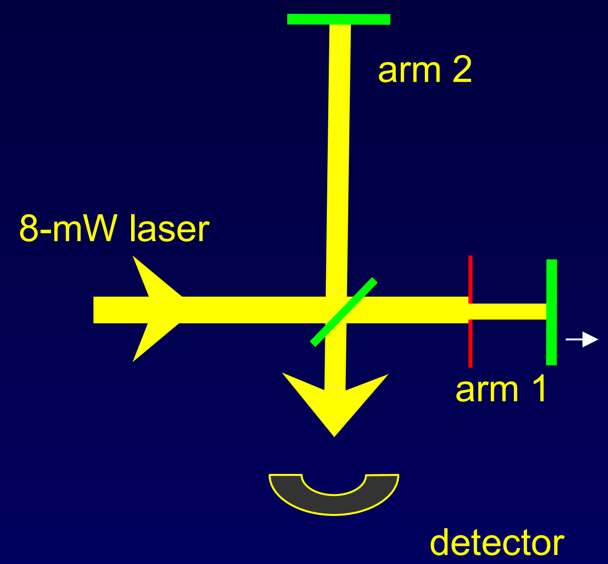
Solution

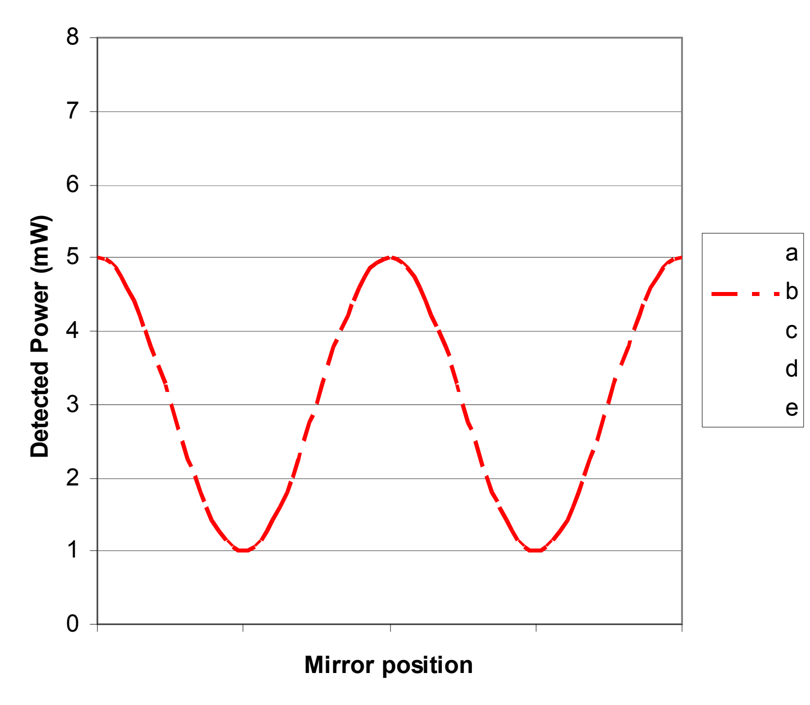
We can use our rules for quantum mechanical interference to understand classical interference too. Consider a Michelson interferometer, into which is directed an 8-mW laser with a 1-cm beam diameter.



We now put an iris in arm 1, centered on the beam, that reduces its diameter to only 0.71 cm, so that the power coming to the detector just from that arm is only 1 mW (and still 2 mW from the other path, whose beam is still 1 cm in diameter).

As we move the arm 1 mirror outward, which of the following curves might describe the power measured on the detector?

(Hint: what's required for interference.)



b. red curve (varies from 1 to 5 mW)

Interference can only occur if the contributing processes are indistinguishable. In this problem, that's only the case for photons inside the 0.71-cm diameter disk, which could have come from either arm. Inside that disk, we have perfect interference (0 → 4 mW). But the detector also sees the non-interfering 1 mW from the outer ring from arm 2. This adds as a background.