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> restart;

with(plots);

unprotect( $\gamma$ );

Digits := 20;

c := 299792458;

 $\lambda$  := 1.310E-6;

NumberOfLoops := 15;
BendRadius := 0.015;
SingleLoopWidth := 2 · BendRadius;
SingleLoopLength := 0.304;
TotalArmLength := NumberOfLoops · SingleLoopLength;
TotalArmWidth := NumberOfLoops · SingleLoopWidth;
TotalFiberLengthPerArm := evalf(NumberOfLoops · 2 · (SingleLoopLength +  $\pi$  · BendRadius));

Altitude := 26.25 ·  $\frac{\pi}{180}$ ;

Azimuth := 191.25;

vWind := -486000;

v := evalf(vWind · abs(cos(Altitude)));

n1 := 1.44915;
n2 := 1.44975;

n := n2;

 $\gamma := \text{evalf}\left(\frac{1}{\text{sqrt}\left(1 - \left(\frac{v}{c}\right)^2\right)}\right)$ ;

cn :=  $\frac{c}{n}$ ;

FractionOfTimeLightIsHeldByMolecules :=  $\frac{(n-1)}{n}$ ;

TimeLightIsHeldByMolecules :=  $\gamma \cdot \text{FractionOfTimeLightIsHeldByMolecules} \cdot \frac{L}{cn}$ ;

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$$t0 := \frac{L}{cn};$$

$$L1 := \text{sqrt}(L^2 + (\text{abs}(v) \cdot dtDiagonal - \text{abs}(v) \cdot \text{TimeLightIsHeldByMolecules})^2);$$

$$Eqdt0 := dtDiagonal = t0 + \left( \frac{L1 - L}{c} \right);$$

$$\theta := '\theta';$$

$$\text{unitXcomponent} := \text{abs}(\cos(\theta)^2);$$

$$\text{unitYcomponent} := \text{abs}(\sin(\theta)^2);$$

$$\text{TotalArmLengthA} := \text{unitXcomponent} \cdot \text{TotalArmLength};$$

$$\text{TotalArmWidthA} := \text{unitYcomponent} \cdot \text{TotalArmWidth};$$

$$\text{TotalArmLengthB} := \text{unitYcomponent} \cdot \text{TotalArmLength};$$

$$\text{TotalArmWidthB} := \text{unitXcomponent} \cdot \text{TotalArmWidth};$$

$$L := \text{TotalArmLengthA};$$

$$dt\text{TotalArmLengthA} := \text{solve}(Eqdt0, dtDiagonal)_1;$$

$$L := \text{TotalArmWidthA};$$

$$dt\text{TotalArmWidthA} := \text{solve}(Eqdt0, dtDiagonal)_1;$$

$$L := \text{TotalArmLengthB};$$

$$dt\text{TotalArmLengthB} := \text{solve}(Eqdt0, dtDiagonal)_1;$$

$$L := \text{TotalArmWidthB};$$

$$dt\text{TotalArmWidthB} := \text{solve}(Eqdt0, dtDiagonal)_1;$$

$$dt\text{PerpendicularArm1} := 2 \cdot (dt\text{TotalArmLengthA} + dt\text{TotalArmWidthA});$$

$$dt\text{PerpendicularArm2} := 2 \cdot (dt\text{TotalArmLengthB} + dt\text{TotalArmWidthB});$$

$$L := 'L';$$

$$TotalArmLengthContractedA := \frac{unitYcomponent \cdot TotalArmLength}{\gamma};$$

$$TotalArmWidthContractedA := \frac{unitXcomponent \cdot TotalArmWidth}{\gamma};$$

$$TotalArmLengthContractedB := \frac{unitXcomponent \cdot TotalArmLength}{\gamma};$$

$$TotalArmWidthContractedB := \frac{unitYcomponent \cdot TotalArmWidth}{\gamma};$$

$$dtParallelArm1 := \frac{TotalArmLengthContractedA + TotalArmWidthContractedA}{(c + v)} + \frac{TotalArmLengthContractedA + TotalArmWidthContractedA}{(c - v)};$$

$$dtParallelArm2 := \frac{TotalArmLengthContractedB + TotalArmWidthContractedB}{(c + v)} + \frac{TotalArmLengthContractedB + TotalArmWidthContractedB}{(c - v)};$$

$$dtArm1 := (dtPerpendicularArm1 + dtParallelArm1);$$

$$dtArm2 := (dtPerpendicularArm2 + dtParallelArm2);$$

$$dxArm1 := dtArm1 \cdot c;$$

$$dxArm2 := dtArm2 \cdot c;$$

$$d\theta_{arm1} := \frac{dxArm1}{\lambda} \cdot 2 \cdot \pi;$$

$$d\theta_{arm2} := \frac{dxArm2}{\lambda} \cdot 2 \cdot \pi;$$

$$LightIntensityEnvelope := 2 \cdot \sin(d\theta_{arm1} - d\theta_{arm2});$$

$$WaveArm1 := \sin(d\theta_{arm1});$$

$$WaveArm2 := \sin(d\theta_{arm2});$$

$LightIntensity := WaveArm1 + WaveArm2;$

$TimeDifference := \frac{Shift \cdot \lambda}{c};$

$dtEq := TimeDifference = dtArm1 - dtArm2;$

$FringeShift := evalf(solve(dtEq, Shift));$

$plot0 := plot(FringeShift, \theta = 0 .. 2 \pi, view = [0 .. 2 \pi, -5 .. 5]);$

$plot1a := plot(LightIntensityEnvelope, \theta = 0 .. 2 \pi, view = [0 .. 2 \pi, -10 .. 10]);$

$plot1b := plot(LightIntensityEnvelope, \theta = 0 .. 2 \pi, view = [0 .. 2 \pi, -10 .. 10]);$

$plot2 := plot(LightIntensityEnvelope, \theta = 0 .. \frac{\pi}{2}, view = [0 .. \frac{\pi}{2}, -10 .. 10]);$

$plot3 := plot(LightIntensityEnvelope, \theta = 260 \cdot \frac{\pi}{180} .. 360 \cdot \frac{\pi}{180}, view = [260 \cdot \frac{\pi}{180} .. 360 \cdot \frac{\pi}{180}, -10 .. 10]);$

$StartAngle := (270 - (180 - Azimuth)) \cdot \frac{\pi}{180};$

$FinishAngle := (360 - (180 - Azimuth)) \cdot \frac{\pi}{180};$

$plot4 := plot(FringeShift, \theta = StartAngle .. FinishAngle, view = [StartAngle .. FinishAngle, -5 .. 5]);$

$display([plot0]);$

$display([plot1a]);$

$display([plot1b]);$

$display([plot2]);$

$display([plot3]);$

$display([plot4]);$

[\[animate, animate3d, animatecurve, arrow, changecoords, complexplot, complexplot3d,](#)

*conformal, conformal3d, contourplot, contourplot3d, coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot, fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal, interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d, listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot, multiple, odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot, polygonplot, polygonplot3d, polyhedra\_supported, polyhedraplot, rootlocus, semilogplot, setcolors, setoptions, setoptions3d, spacecurve, sparsematrixplot, surfdata, textplot, textplot3d, tubeplot]*

$$Digits := 20$$

$$c := 299792458$$

$$\lambda := 0.000001310$$

$$NumberOfLoops := 15$$

$$BendRadius := 0.015$$

$$SingleLoopWidth := 0.030$$

$$SingleLoopLength := 0.304$$

$$TotalArmLength := 4.560$$

$$TotalArmWidth := 0.450$$

$$TotalFiberLengthPerArm := 10.533716694115406957$$

$$Altitude := 0.14583333333333333333 \pi$$

$$Azimuth := 191.25$$

$$vWind := -486000$$

$$v := -4.3588015238488651570 \cdot 10^5$$

$$n1 := 1.44915$$

$$n2 := 1.44975$$

$$n := 1.44975$$

$$\gamma := 1.0000010569719817009$$

$$cn := 2.0678907259872391792 \cdot 10^8$$

$$FractionOfTimeLightIsHeldByMolecules := 0.31022590101741679600$$

$$TimeLightIsHeldByMolecules := 1.5002061038278313525 \cdot 10^{-9} L$$

$$t0 := 4.8358454701352093386 \cdot 10^{-9} L$$

$$L1 := \sqrt{L^2 + (4.3588015238488651570 \cdot 10^5 dtDiagonal - 0.00065391006514521201189 L)^2}$$

$$Eqdt0 := dtDiagonal = 1.5002045181536888428 \cdot 10^{-9} L$$

$$+ \frac{1}{299792458}$$

$$\sqrt{L^2 + (4.3588015238488651570 \cdot 10^5 dtDiagonal - 0.00065391006514521201189 L)^2}$$

$$\theta := \theta$$

$$unitXcomponent := |\cos(\theta)|^2$$

$$unitYcomponent := |\sin(\theta)|^2$$

$$TotalArmLengthA := 4.560 |\cos(\theta)|^2$$

$$TotalArmWidthA := 0.450 |\sin(\theta)|^2$$

$$TotalArmLengthB := 4.560 |\sin(\theta)|^2$$

$$TotalArmWidthB := 0.450 |\cos(\theta)|^2$$

$$L := 4.560 |\cos(\theta)|^2$$

$$dtTotalArmLengthA := 2.2051471420897633638 \cdot 10^{-8} |\cos(\theta)|^2$$

$$L := 0.450 |\sin(\theta)|^2$$

$$dtTotalArmWidthA := 2.1761320481148980564 \cdot 10^{-9} |\sin(\theta)|^2$$

$$L := 4.560 |\sin(\theta)|^2$$

$$dtTotalArmLengthB := 2.2051471420897633638 \cdot 10^{-8} |\sin(\theta)|^2$$

$$L := 0.450 |\cos(\theta)|^2$$

$$dtTotalArmWidthB := 2.1761320481148980564 \cdot 10^{-9} |\cos(\theta)|^2$$

$$dtPerpendicularArm1 := 4.4102942841795267276 \cdot 10^{-8} |\cos(\theta)|^2$$

$$+ 4.3522640962297961128 \cdot 10^{-9} |\sin(\theta)|^2$$

$$dtPerpendicularArm2 := 4.4102942841795267276 \cdot 10^{-8} |\sin(\theta)|^2$$

$$+ 4.3522640962297961128 \cdot 10^{-9} |\cos(\theta)|^2$$

$$L := L$$

$$TotalArmLengthContractedA := 4.5599951802128578239 |\sin(\theta)|^2$$

$$TotalArmWidthContractedA := 0.44999952436311096946 |\cos(\theta)|^2$$

$$TotalArmLengthContractedB := 4.5599951802128578239 |\cos(\theta)|^2$$

$$TotalArmWidthContractedB := 0.44999952436311096946 |\sin(\theta)|^2$$

$$dtParallelArm1 := 4.4102957303174017453 \cdot 10^{-8} |\sin(\theta)|^2$$

$$+ 4.3522655233395411959 \cdot 10^{-9} |\cos(\theta)|^2$$

$$dtParallelArm2 := 4.4102957303174017453 \cdot 10^{-8} |\cos(\theta)|^2$$

$$+ 4.3522655233395411959 \cdot 10^{-9} |\sin(\theta)|^2$$

$$dtArm1 := 4.8455208365134808472 \cdot 10^{-8} |\cos(\theta)|^2 + 4.8455221399403813566 \cdot 10^{-8} |\sin(\theta)|^2$$

$$dtArm2 := 4.8455208365134808472 \cdot 10^{-8} |\sin(\theta)|^2 + 4.8455221399403813566 \cdot 10^{-8} |\cos(\theta)|^2$$

$$dxArm1 := 14.526506018685925733 |\cos(\theta)|^2 + 14.526509926261469004 |\sin(\theta)|^2$$

$$dxArm2 := 14.526506018685925733 |\sin(\theta)|^2 + 14.526509926261469004 |\cos(\theta)|^2$$

$$d\theta arm1 := 1.5267175572519083969 \cdot 10^6 (14.526506018685925733 |\cos(\theta)|^2$$

$$+ 14.526509926261469004 |\sin(\theta)|^2) \pi$$

$$d\theta arm2 := 1.5267175572519083969 \cdot 10^6 (14.526506018685925733 |\sin(\theta)|^2$$

$$+ 14.526509926261469004 |\cos(\theta)|^2) \pi$$

$$\text{LightIntensityEnvelope} := -2 \sin(\$$

$$-1.5267175572519083969 \cdot 10^6 (14.526506018685925733 |\cos(\theta)|^2$$

$$+ 14.526509926261469004 |\sin(\theta)|^2) \pi$$

$$+ 1.5267175572519083969 \cdot 10^6 (14.526506018685925733 |\sin(\theta)|^2$$

$$+ 14.526509926261469004 |\cos(\theta)|^2) \pi)$$

$$\text{WaveArm1} := \sin(1.5267175572519083969 \cdot 10^6 (14.526506018685925733 |\cos(\theta)|^2$$

$$+ 14.526509926261469004 |\sin(\theta)|^2) \pi)$$

$$\text{WaveArm2} := \sin(1.5267175572519083969 \cdot 10^6 (14.526506018685925733 |\sin(\theta)|^2$$

$$+ 14.526509926261469004 |\cos(\theta)|^2) \pi)$$

$$\text{LightIntensity} := \sin(1.5267175572519083969 \cdot 10^6 (14.526506018685925733 |\cos(\theta)|^2$$

$$+ 14.526509926261469004 |\sin(\theta)|^2) \pi)$$

$$+ \sin(1.5267175572519083969 \cdot 10^6 (14.526506018685925733 |\sin(\theta)|^2$$

$$+ 14.526509926261469004 |\cos(\theta)|^2) \pi)$$

$$\text{TimeDifference} := 4.3696896470957918494 \cdot 10^{-15} \text{Shift}$$

$$\text{dtEq} := 4.3696896470957918494 \cdot 10^{-15} \text{Shift} = -1.3034269005094 \cdot 10^{-14} |\cos(\theta)|^2$$

$$+ 1.3034269005094 \cdot 10^{-14} |\sin(\theta)|^2$$

$$\text{FringeShift} := -2.9828820940994998329 |\cos(\theta)|^2 + 2.9828820940994998329 |\sin(\theta)|^2$$

$$\text{plot0} := \text{PLOT}(\dots)$$

$$\text{plot1a} := \text{PLOT}(\dots)$$

$$\text{plot1b} := \text{PLOT}(\dots)$$

$$\text{plot2} := \text{PLOT}(\dots)$$

$$\text{plot3} := \text{PLOT}(\dots)$$

$$\text{StartAngle} := 1.56250000000000000000 \pi$$

$$\text{FinishAngle} := 2.06250000000000000000 \pi$$

$$\text{plot4} := \text{PLOT}(\dots)$$













