```
> restart;

  with(plots);

  unprotect(γ);

  Digits := 50;


  c := 299792458;

  λ := c/10.0E6;


  NumberOfLoops := 1;
  SingleLoopLength := 5/2;

  TotalArmLength := NumberOfLoops·SingleLoopLength;
  Altitude := 0·π/180;

  Azimuth := 180;

  vWind := 486000;

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

  # ArmA: Cable OUT is coaxial cable followed by single-mode optic fiber
  #       Cable IN is single-mode optic fiber followed by coaxial cable

  # ArmB:  Cable OUT is single-mode optic fiber followed by coaxial cable
  #       Cable IN is coaxial cable followed by single-mode optic fiber

  n1 := 1.19;
  n2 := 1.44975;

  θ := π/4;
     # X and Y components are equal as signal is traveling around a loop - so no changing θ

  unitXcomponent := abs(cos(θ)^2);

  unitYcomponent := abs(sin(θ)^2);
```

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

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

$$TimeLightIsHeldByMolecules := \gamma \cdot FractionOfTimeLightIsHeldByMolecules \cdot \frac{L \cdot n}{c};$$

$$Eqdtn := dtDiagonal = \gamma \cdot TimeLightIsHeldByMolecules + \frac{\gamma \cdot L}{c};$$

$$EqdtnOptic := dtDiagonalOptic = TimeLightIsHeldByMolecules + \frac{\gamma \cdot L}{c};$$

$$L := unitXcomponent \cdot TotalArmLength;$$

$n := n1;$ # Coaxial cable

$dtTotalArmLengthAout := solve(Eqdtn, dtDiagonal);$

$n := n2;$ # Optic fiber

$dtTotalArmLengthAin := solve(EqdtnOptic, dtDiagonalOptic);$

$n := n2;$ # Optic fiber

$dtTotalArmLengthBout := solve(EqdtnOptic, dtDiagonalOptic);$

$n := n1;$ # Coaxial cable

$dtTotalArmLengthBin := solve(Eqdtn, dtDiagonal);$

$dtPerpendicularComponentArmA := dtTotalArmLengthAout + dtTotalArmLengthAin + dtTotalArmLengthBout + dtTotalArmLengthBin;;$

$dtPerpendicularComponentArmB := dtTotalArmLengthBout + dtTotalArmLengthBin + dtTotalArmLengthAout + dtTotalArmLengthAin ;$

$L := 'L';$
$n := 'n';$

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

$$TimeLightIsHeldByMoleculesInMovingFrameUp := FractionOfTimeLightIsHeldByMoleculesUp \cdot \frac{L \cdot n}{c};$$

$$TimeLightIsHeldByMoleculesInAetherFrameUp := \gamma \cdot TimeLightIsHeldByMoleculesInMovingFrameUp;$$

$$opticalPathLengthUp := \frac{L}{\gamma} + v \cdot dtup - v \cdot TimeLightIsHeldByMoleculesInAetherFrameUp;$$

$$dtupEqn := dtup = \frac{opticalPathLengthUp}{c} + TimeLightIsHeldByMoleculesInAetherFrameUp;$$

$$dtup := solve(dtupEqn, dtup);$$

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

$$TimeLightIsHeldByMoleculesInMovingFrameDown := FractionOfTimeLightIsHeldByMoleculesDown \cdot \frac{L \cdot n}{c};$$

$$TimeLightIsHeldByMoleculesInAetherFrameDown := \gamma \cdot TimeLightIsHeldByMoleculesInMovingFrameDown;$$

$$opticalPathLengthDown := \frac{L}{\gamma} - v \cdot dtdown + v \cdot TimeLightIsHeldByMoleculesInAetherFrameDown;$$

$$dtdownEqn := dtdown = \frac{opticalPathLengthDown}{c} + TimeLightIsHeldByMoleculesInAetherFrameDown;$$

$$dtdown := solve(dtdownEqn, dtdown);$$

$$L := unitYcomponent \cdot TotalArmLength;$$

$n := n1;$ # Coaxial cable

$dtArmAout := dtup;$

$n := n2;$ # Optic fiber

$dtArmAin := dtdown;$

$L := unitYcomponent \cdot TotalArmLength;$

$n := n2;$ # Optic fiber

$dtArmBout := dtup;$

$n := n1;$ # Coaxial cable

$dtArmBin := dtdown;$

$dtParallelComponentArmA := dtArmAout + dtArmAin + dtArmBout + dtArmBin;$

$dtParallelComponentArmB := dtArmBout + dtArmBin + dtArmAout + dtArmAin;$

$$dtArmA := \frac{1}{\gamma} \cdot (dtPerpendicularComponentArmA + dtParallelComponentArmA);$$

$$dtArmB := \frac{1}{\gamma} \cdot (dtPerpendicularComponentArmB + dtParallelComponentArmB);$$

$L := 'L';$
$Lcontracted := 'Lcontracted';$
$v := 'v';$
$n := 'n';$

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

$dtdiff := dtArmA - dtArmB;$

$dtsum := dtArmA + dtArmB;$

$dtEq := TimeDifference = dtsum;$

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

$dtArmAresult := evalf(dtArmA \cdot 1E12);$
$dtArmBresult := evalf(dtArmB \cdot 1E12);$
$dtdiffResult := evalf(dtdiff \cdot 1E12);$
$dtsumResult := evalf(dtsum \cdot 1E12);$
$FringeShift := evalf(FringeShift);$
$FringeShiftDistanceResult := evalf(FringeShift \cdot \lambda);$

$MaximumTimeDifferenceInPicosecondsOnRotation := dtsumResult;$

[*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*]

$$Digits := 50$$

$$c := 299792458$$

$$\lambda := 29.979245800000000000000000000000000000000000000000$$

$$NumberOfLoops := 1$$

$$SingleLoopLength := \frac{5}{2}$$

$$TotalArmLength := \frac{5}{2}$$

$$Altitude := 0$$

$$Azimuth := 180$$

$$vWind := 486000$$

$$v := 4.86000\ 10^{5}$$

$$n1 := 1.19$$

$$n2 := 1.44975$$

$$\theta := \frac{1}{4}\ \pi$$

$$unitXcomponent := \frac{1}{2}$$

$$unitYcomponent := \frac{1}{2}$$

$$\gamma := 1.000001314020053166714787832695893795680250295411 7$$

$$FractionOfTimeLightIsHeldByMolecules := \frac{n-1}{n}$$

$$TimeLightIsHeldByMolecules := 3.335645335080621563584457593979544994691795400042 1\ 10^{-9}\ (n-1)\ L$$

$$Eqdtn := dtDiagonal = 3.335649718185482111526968171259008092885309529359 7\ 10^{-9}\ (n-1)\ L + 3.335645335080621563584457593979544994691795400042 1\ 10^{-9}\ L$$

$$EqdtnOptic := dtDiagonalOptic = 3.335645335080621563584457593979544994691795400042 1\ 10^{-9}\ (n-1)\ L + 3.335645335080621563584457593979544994691795400042 1\ 10^{-9}\ L$$

$$L := \frac{5}{4}$$

$$n := 1.19$$

$$dtTotalArmLengthAout := 4.96177347691982895596822693314844566542500526327555\ 10^{-9}$$

$$n := 1.44975$$

$$dtTotalArmLengthAin := 6.04481478066641388975820924608980669506803797651385\ 10^{-9}$$

$$n := 1.44975$$

$$dtTotalArmLengthBout := 6.04481478066641388975820924608980669506803797651385\ 10^{-9}$$

$$n := 1.19$$

$$dtTotalArmLengthBin := 4.96177347691982895596822693314844566542500526327555\ 10^{-9}$$

$$dtPerpendicularComponentArmA := 2.20131765151724856914528723584765047209860864795785\ 10^{-8}$$

$$dtPerpendicularComponentArmB := 2.20131765151724856914528723584765047209860864795785\ 10^{-8}$$

$$L := L$$

$$n := n$$

$$FractionOfTimeLightIsHeldByMoleculesUp := \frac{n-1}{n}$$

$$TimeLightIsHeldByMoleculesInMovingFrameUp := \frac{1}{299792458}\ (n-1)\ L$$

$$TimeLightIsHeldByMoleculesInAetherFrameUp := 3.335645335080621563584457593979544994691795400042\ 10^{-9}\ (n-1)\ L$$

$$opticalPathLengthUp := 0.999998685981673479716488387836123949193286416476\ L + 4.86000\ 10^{5}\ dtup - 0.001621123632849182079902046390674058867420212564420\ (n-1)\ L$$

$$dtupEqn := dtup = 3.335636568888178900472834402779151799720346588826\ 10^{-9}\ L + 0.001621121502663018960937302832348103967311946186451\ dtup + 3.330237848702664776960085454535416420692044503825\ 10^{-9}\ (n-1)\ L$$

$$dtup := 5.407486377956786624372139444128573999750896216695\ 10^{-12}\ L + 3.335645335080621563584457593979544994691795400042\ 10^{-9}\ L\ n$$

$$FractionOfTimeLightIsHeldByMoleculesDown := \frac{n-1}{n}$$

$$TimeLightIsHeldByMoleculesInMovingFrameDown := \frac{1}{299792458}\ (n-1)\ L$$

$$TimeLightIsHeldByMoleculesInAetherFrameDown := 3.335645335080621563584457593979544994691795400042\ 10^{-9}\ (n-1)\ L$$

$$opticalPathLengthDown := 0.999998685981673479716488387836123949193286416476\ L - 4.86000\ 10^{5}\ dtdown + 0.001621123632849182079902046390674058867420212564420\ (n-1)\ L$$

$$dtdownEqn := dtdown = 3.335636568888178900472834402779151799720346588826\ 10^{-9}\ L - 0.001621121502663018960937302832348103967311946186451\ dtdown + 3.341052821458578350208829733423673568691546296258\ 10^{-9}\ (n-1)\ L$$

$$dtdown := -5.407486377956786624372139444128573999750896216105 4\ 10^{-12}\ L + 3.335645335080621563584457593979544994691795400042 1\ 10^{-9}\ L\ n$$

$$L := \frac{5}{4}$$

$$n := 1.19$$

$$dtArmAout := 4.968531793904870559112345845349733897103734277833 5\ 10^{-9}$$

$$n := 1.44975$$

$$dtArmAin := 6.038055422693967906477744071784645977568349356243 7\ 10^{-9}$$

$$L := \frac{5}{4}$$

$$n := 1.44975$$

$$dtArmBout := 6.051574138638859873038674420394967412567726596784 7\ 10^{-9}$$

$$n := 1.19$$

$$dtArmBin := 4.955013077959978592551415496739412462104357037292 5\ 10^{-9}$$

$$dtParallelComponentArmA := 2.201317443319767693118017983426875974934416726815 4\ 10^{-8}$$

$$dtParallelComponentArmB := 2.201317443319767693118017983426875974934416726815 4\ 10^{-8}$$

$$dtArmA := 4.402629309693816665057505956514272801668719394642 3\ 10^{-8}$$

$$dtArmB := 4.402629309693816665057505956514272801668719394642 3\ 10^{-8}$$

$$L := L$$

$$Lcontracted := Lcontracted$$

$$v := v$$

$$n := n$$

$$TimeDifference := 1.000000000000000000000000000000000000000000000000000\ 10^{-7}\ Shift$$

$$dtdiff := 0.$$

$$dtsum := 8.805258619387633330115011913028545603337438789284 6\ 10^{-8}$$

$$dtEq := 1.000000000000000000000000000000000000000000000000000\ 10^{-7}\ Shift = 8.805258619387633330115011913028545603337438789284 6\ 10^{-8}$$

$$FringeShift := 0.880525861938763333011501191302854560333743878928 46$$

$$dtArmAresult := 44026.293096938166650575059565142728016687193946423$$

$$dtArmBresult := 44026.293096938166650575059565142728016687193946423$$

$$dtdiffResult := 0.$$

$$dtsumResult := 88052.586193876333301150119130285456033374387892846$$

$$FringeShift := 0.880525861938763333011501191302854560333743878928 46$$

$$FringeShiftDistanceResult := 26.397501248319050508379048441061099105896237780642$$

$$MaximumTimeDifferenceInPicosecondsOnRotation := 88052.586193876333301150119130285456033374387892846 \quad \textbf{(1)}$$