Internal Light Source-Purcell Factor

-PurcellFactorCmd.pyc

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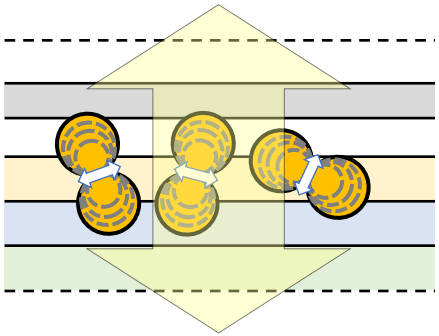
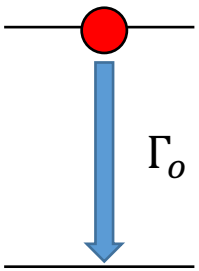


Objective

- Calculate the Purcell Factor.
- The interaction between the structure and the electromagnetic (EM) field would influence the radiation rate of a emitter. Also, the internal quantum efficiency (IQE) would be influenced by the structure.

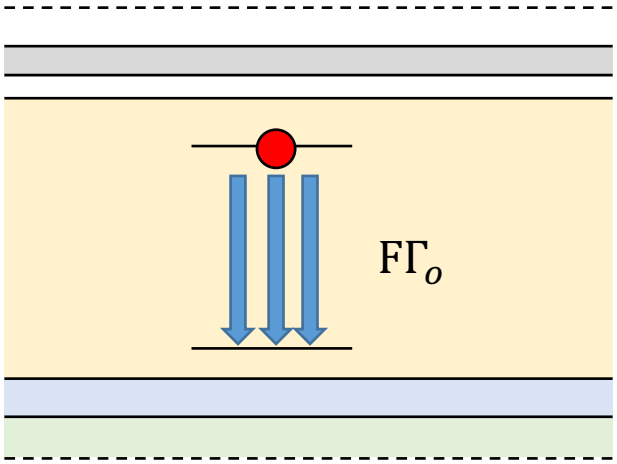
Free Space (Reference Structure)



Γ_o intrinsic rate constant

η_o intrinsic quantum yield

In cavity



$$\Gamma(rate\ constant) = F\Gamma_o$$

$$\eta(IQE) = \frac{F\eta_o}{(1-\eta_o) + F\eta_o}$$

How to execute the calculator

python: windows
python3: mac, linux

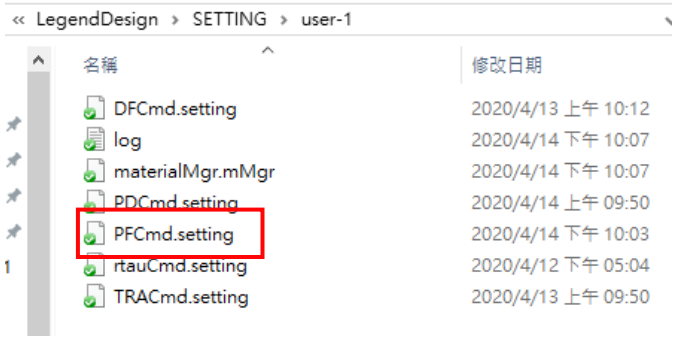
```
>python PurcellFactorCmd.pyc
```

Execution file

```
>>> Please insert username : user-1
```

Type user name

```
Purcell Factor Setting is not built in ../../SETTING/user-1
Now saving the default Purcell factor setting.
```

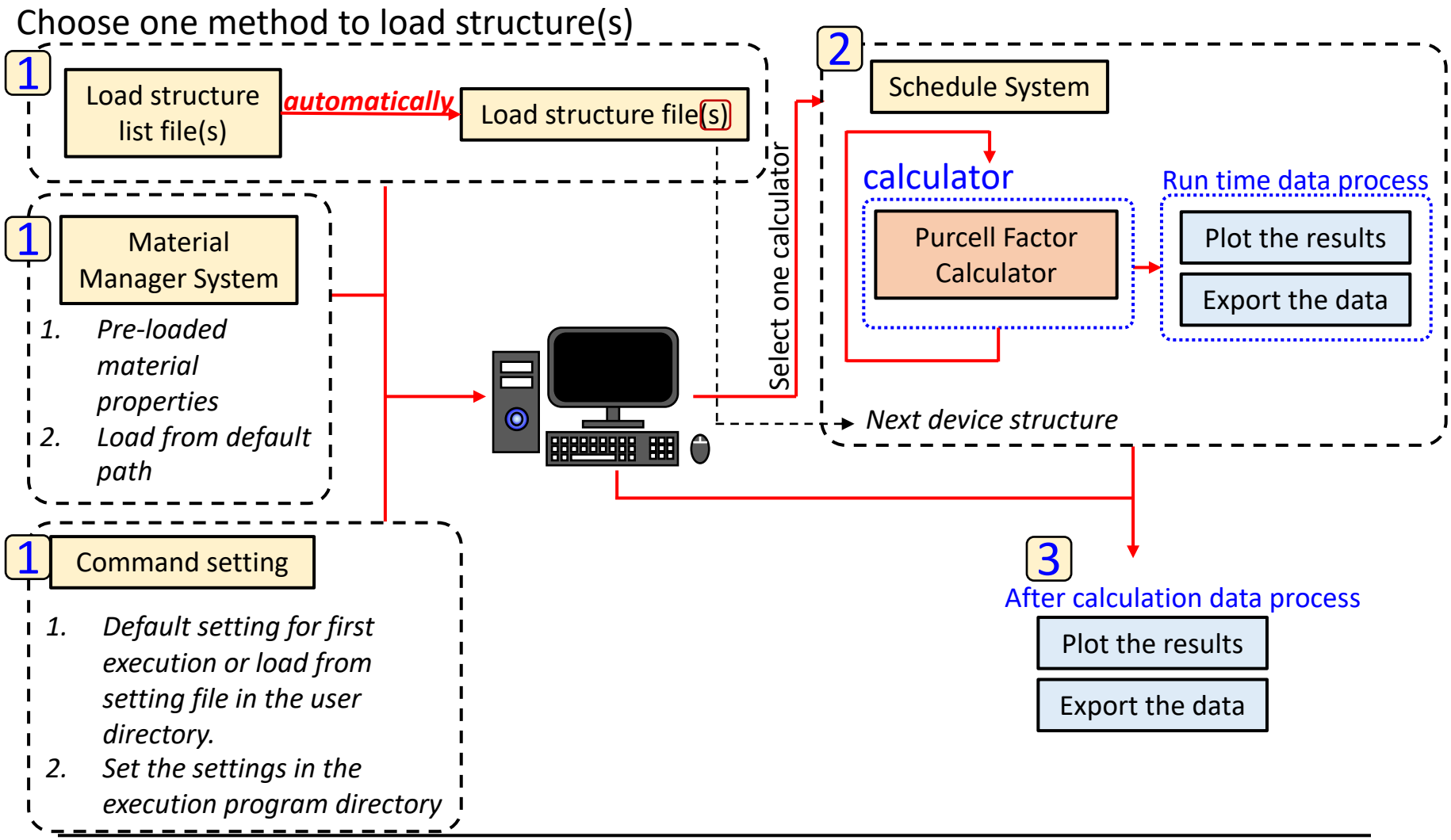


Help

```
>>> ?

User Control Command
========================================
1. Settting Command:
changeUser              exit

Material Manager Command
========================================
1. Settting Command:
printMgr                saveMgr

Structure/Structure List Command
========================================
1. Structure List Command:
ReadStructListPath      ReadStructListName
SaveStructListPath      SaveStructListName
readStructList          saveStructList

2. Structure Command:
ReadStructPath          ReadStructName
SaveFilePath            SaveFileName
readStruct              deleteStruct

3. Print Information Command:
printStructInfo         printStructSettingInfo
printListInfo

4. Result Command:
ResultFilePath          ResultFileName
deleteResult
save_run_time_result_Bool
resetSN
```

```
Purcell Factor Command
**** Check the integration parameters !!!
========================================
1. Settting Command:
SettingFilePath         SettingFileName
setDefaultSetting       printPFInfo
loadPFSETTING           savePFSETTING

2. Reference Purcell Factor Command:
ReferencePurcellFactorFilePath
ReferencePurcellFactorFileName
readRefPurcellFactor

3. Purcell Factor Wavelength:
kkomax                  ----Integration Parameter
tol                     recursivelimit          ----Integration Parameter
calWVPurcellFactor      plotWVPurcellFactor
printIntegrationInformation

4. Plot Bool:
changefigshowBool

5. Run Time Bool:
runtime_plot
```

Calculating Workflow



Default Setting

```
>>> printPFInfo

Setting file path : ../../SETTING/user-1
Setting file name : PFCmd.setting
The upper bound of kx/ko, ky/ko and kt/ko : 15.0
The integral tolerance : 0.001
The recursive limit of integral : 25
The inital points number when integration : 100
Reference Purcell factor file path : E:\Dropbox\GoodLabSimulator_aniso\LegendDesign\ori_src\Optics\WaveOptics\SourceOp
Reference Purcell factor file name : AirPurcellFactor
Print integration information : False
Save Run Time Result  : True
Run Time Plot         : False

Figure Show Bool : True
```

Integration parameters

Reference Purcell Factor File

AirPurcellFactor.txt

	wavelength	PurcellFactor
2	0	1
3	10000	1

Calculate Purcell Factor

Bottom-emitting OLED

sfile-1.txt

	MATERIAL	THICKNESS(nm)
1		
2	air	X
3	Al	120.000000
4	LiF	1.000000
5	B3PYMPM	50
6	CBP	20.000000
7	TAPC	50
8	cito	80
9	glass	X
10		
11		
12		
13		
14	wavelength(nm) : 480.0:10.0:600.0	
15	EML :	
16	Layerno : 5	
17	Position(nm) : 10.000000	
18	ratio : 1.000000	
19	QY : 1.000000	
20	Fluorescence : cbp_irppy2acac	
21	DOF : cbp_irppy2acac	

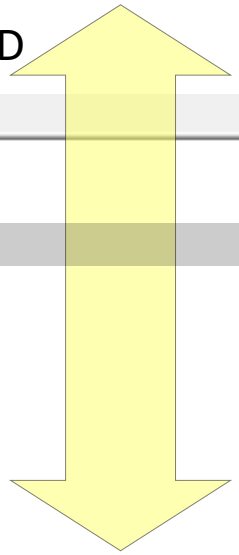
Thick metal

AirPurcellFactor.txt | structureList-PFCmd1.txt | structureList-PFCmd1.txt

	Name	readfilename	readfilepath	savefilename	
1					
2	#s1	sfile-1.txt	./Example/structure/Convention	sfile-1	../../Example/PFCmd-1/Con

Calculate Purcell Factor

Transparent/ Double-emitting OLED



sfile-1.txt

	MATERIAL	THICKNESS(nm)
1	air	X
2	Al	10:5:20
3	LiF	1.000000
4	B3PYMPM	50
5	CBP	20.000000
6	TAPC	20
7	cito	50
8	glass	X
9		
10		
11	wavelength(nm) : 450:10:650.0	
12	EML :	
13	Layerno	: 5
14	Position(nm)	: 10.000000
15	ratio	: 1.000000
16	QY	: 1.000000
17	Fluorescence	: cbp_irppy2acac
18	DOF	: cbp_irppy2acac

Thin metal

AirPurcellFactor.txt | structureList-PFCmd1.txt

	Name	readfilename	readfilepath	savefilename	
1	#Ts1	sfile-1.txt	./Example/structure/Transparent	sfile-1	../../Example/PFCmd-1/Tr

Calculate Purcell Factor

```
>>> changefigshowBool F

>>> save_run_time_result_Bool F

>>> ReadStructListPath  ./Example/structure/Convention

>>> ReadStructListName  structureList-PFCmd1.txt
```

```
>>> readStructList

Now reading structure list file ./Example/structure/Convention\structureList-PFCmd1.txt
  No./Name       filename        savefilename  CommandID  Check                    readfilepath
-------------------------------------------------------------------------------------------------------------
       #s1    sfile-1.txt            sfile-1       0.0      X  ./Example/structure/Convention  ../../Example/PF

Structure file reading...
-------------------------------------------------------------------------------------------
Now reading structure file ./Example/structure/Convention\sfile-1.txt

>>> ReadStructListPath  ./Example/structure/Transparent

>>> ReadStructListName  structureList-PFCmd1.txt

>>> readStructList

Now reading structure list file ./Example/structure/Transparent\structureList-PFCmd1.txt
  No./Name       filename        savefilename  CommandID  Check                    readfilepath
-------------------------------------------------------------------------------------------------------------
      #Ts1    sfile-1.txt            sfile-1       0.0      X  ./Example/structure/Transparent  ../../Example/P

Structure file reading...
-------------------------------------------------------------------------------------------
Now reading structure file ./Example/structure/Transparent\sfile-1.txt
```

Calculate Purcell Factor

```
>>> printStructInfo

****************************************
Name: #s1
[#]   Material             Thickness(nm)
----------------------------------------
[1]   air                  X
[2]   Al                   120.0
[3]   LiF                  1.0
[4]   B3PYMPM              50.0
[5]   CBP                  20.0
[6]   TAPC                 50.0
[7]   cito                 80.0
[8]   glass                X

wavelength(nm) : 480.00000:10.00000:600.00000

EML   Fluorescence    DOF            Position(nm)    PLQY           Ratio
-------------------------------------------------------------------------------------------
[5]   cbp_irppy2acac  cbp_irppy2acac  10.0            1.0            1.0
Device number : 1
```

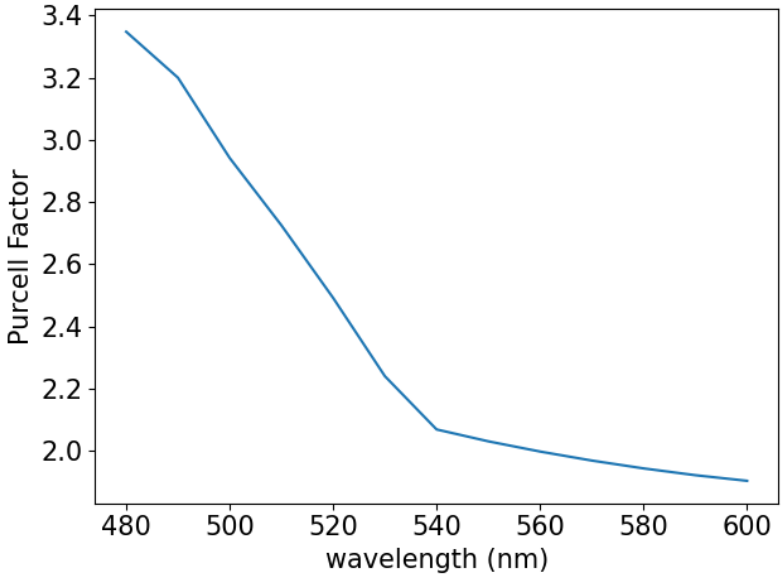
```
****************************************
Name: #Ts1
[#]   Material             Thickness(nm)
----------------------------------------
[1]   air                  X
[2]   Al                   10.00000:5.00000:20.00000
[3]   LiF                  1.0
[4]   B3PYMPM              50.0
[5]   CBP                  20.0
[6]   TAPC                 20.0
[7]   cito                 50.0
[8]   glass                X

wavelength(nm) : 450.00000:10.00000:650.00000

EML   Fluorescence    DOF            Position(nm)    PLQY           Ratio
-------------------------------------------------------------------------------------------
[5]   cbp_irppy2acac  cbp_irppy2acac  10.0            1.0            1.0
Device number : 3
```

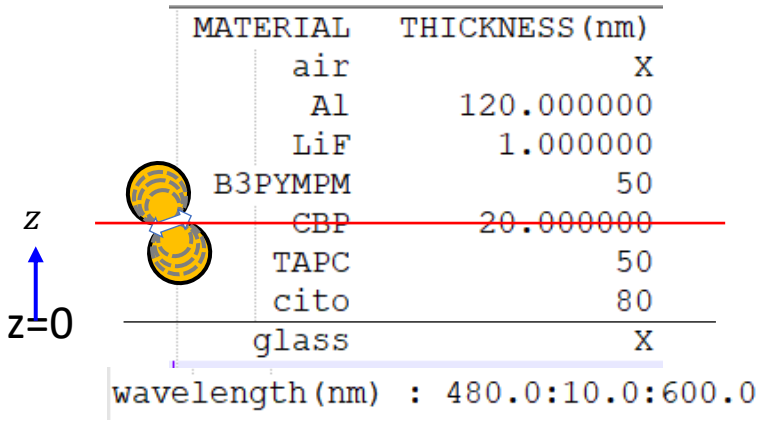
Calculate Purcell Factor

```
>>> runtime_plot         T

>>> calWVPurcellFactor

Now running structure (#1/#2) #s1 ...
|Device-#1/#1|(100%)>>>>>>>>>>>>>>>>>>>>|Elapsed:0day(s)/0hr(s)/0min(s)/29sec(s)
Now running structure (#2/#2) #Ts1 ...
|Device-#3/#3|(100%)>>>>>>>>>>>>>>>>>>>>|Elapsed:0day(s)/0hr(s)/2min(s)/54sec(s)
```

Data at EML

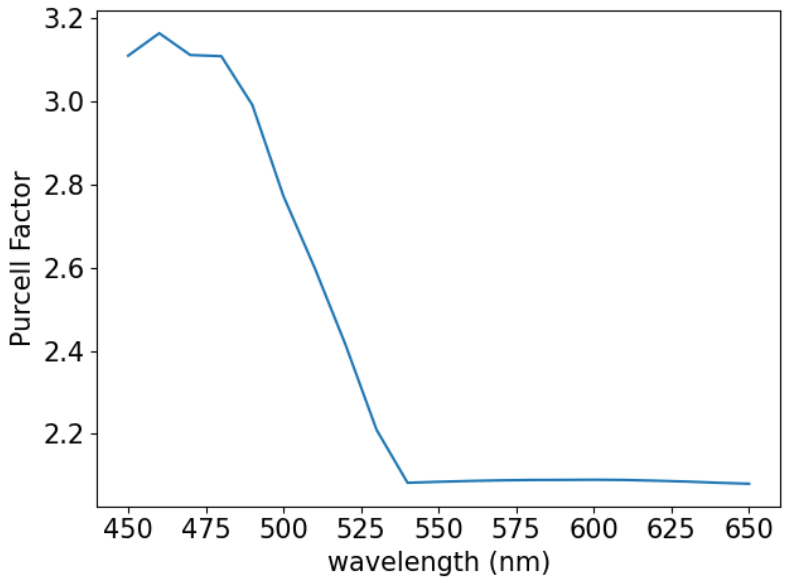
Bottom-emitting OLED

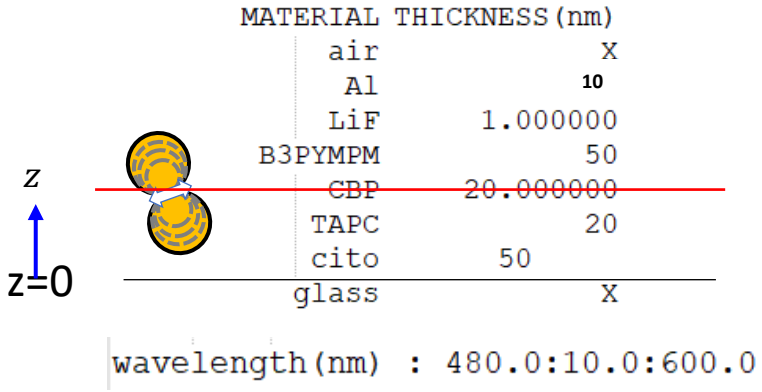




Data at EML

Transparent/ Double-emitting OLED





Exit

Exit the material manager system.
*** The material manager system would be automatically saved into the user's setting directory.

```
>>> exit
------------------------------------------------------------------------------------------------------------
End running GOODLAB anisotropic simulator ver1.0 Tue Apr 14 22:07:05 2020
Elapsed time : 0 day(s)/ 0 hr(s)/ 3 min(s)/ 24.410677433013916 sec(s)
------------------------------------------------------------------------------------------------------------
```