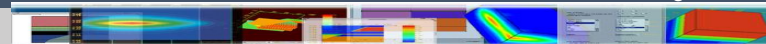







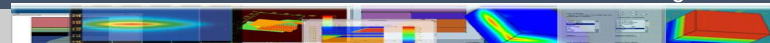
# Crosslight 3D PCSEL仿真

App. Note by  
Simon Li & Michel Lestrade

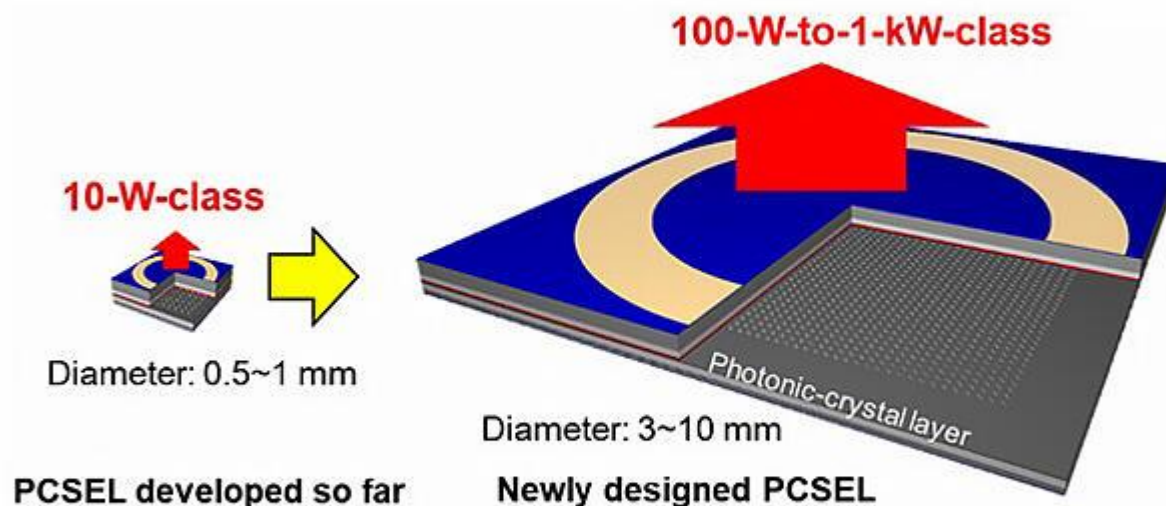


# 目录

-  简介
-  光栅模型
-  窄条近似
-  3D PCSEL 仿真
-  总结



# PCSEL 将成为主流








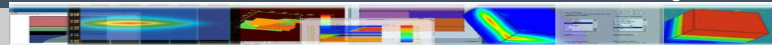
日本京都大学为 3mm 到 10mm 单模激光器，建立大面积 photonic-crystal surface-emitting laser (PCSEL) 的理论 — 他们的目标是在一年内实现50到100瓦级别的发射连续波激光器。

<https://sj.jst.go.jp/news/202209/n0901-01k.html>



# 3D PCSEL 仿真的挑战

-  尺寸比传统的激光器大
-  需要空气孔的细节设置
-  大范围光学分布和量子阱跃迁的相互作用
-  高功率发射需要的热模型
-  这个示例采用了一种多物理尺度的方法，将传统的二阶光栅DFB模型与大型三维PCSEL模型相结合



# 目录

 简介

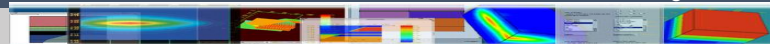


 光栅模型

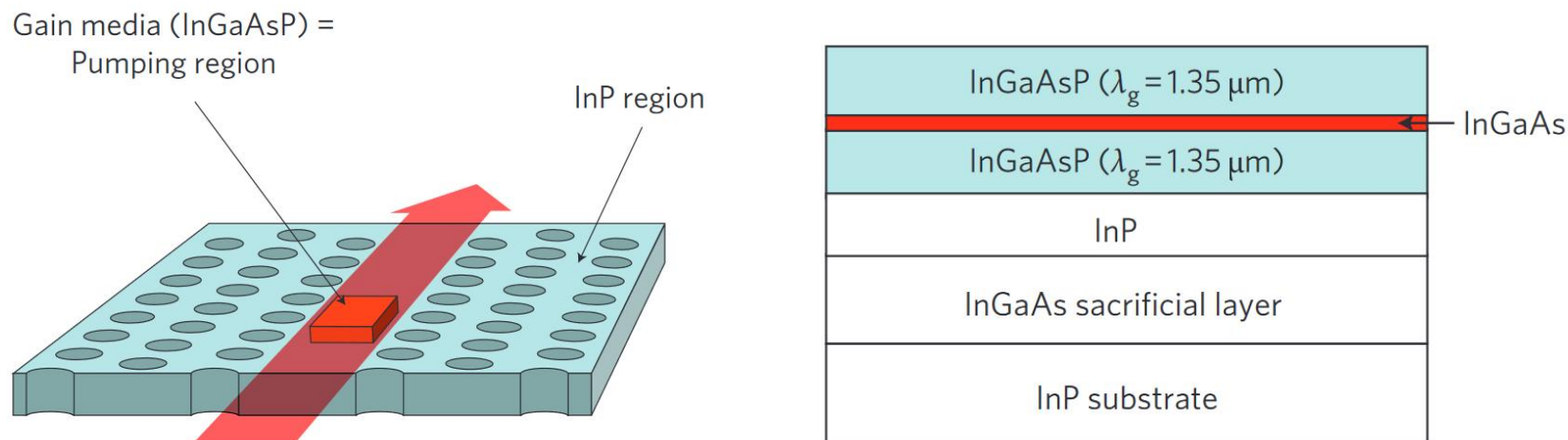
 窄条近似

 3D PCSEL 仿真

 总结

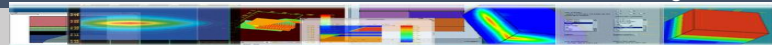


# 垂直多量子阱和空气孔的细节



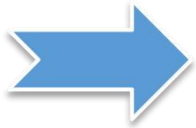
Ref: “High-speed ultracompact buried heterostructure photonic-crystal laser with 13 fJ of energy consumed per bit transmitted,” Shinji Matsuo, et.al.,

<http://www.nature.com/doifinder/10.1038/nphoton.2010.177>



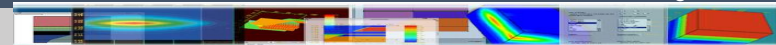
# 把光子晶体看作二阶光栅

```
grating_model real_index_high=3.5 real_index_low=1. &&  
d_high=0.2 d_low=0.2 &&  
grating_xrange=[1.7 1.9] grating_yrange=[0.1 0.9] &&  
grating_order=2 print_data=gratingpara.txt
```



PICS3D 提取  
二阶光栅的参数

```
====> Grating Reg. Opt. Conf.= 4.779947042956008E-002  
2nd order (180 degree diffraction)  
Real coupling coefficient (h2 or kappa) [1/m]  
4.84417641387488  
2nd order (180 degree diffraction)  
Imag coupling coefficient (h2 or kappa) [1/m]  
0.0000000000000000E+000  
1st order (90 degree diffraction)  
Real coupling coefficient (h1) [1/m]  
2072.50459011233  
1st order (90 degree diffraction)  
Imag coupling coefficient (h1) [1/m]  
0.0000000000000000E+000
```



# 目录

 简介

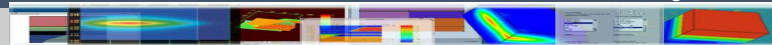
 光栅模型



 窄条近似

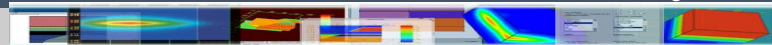
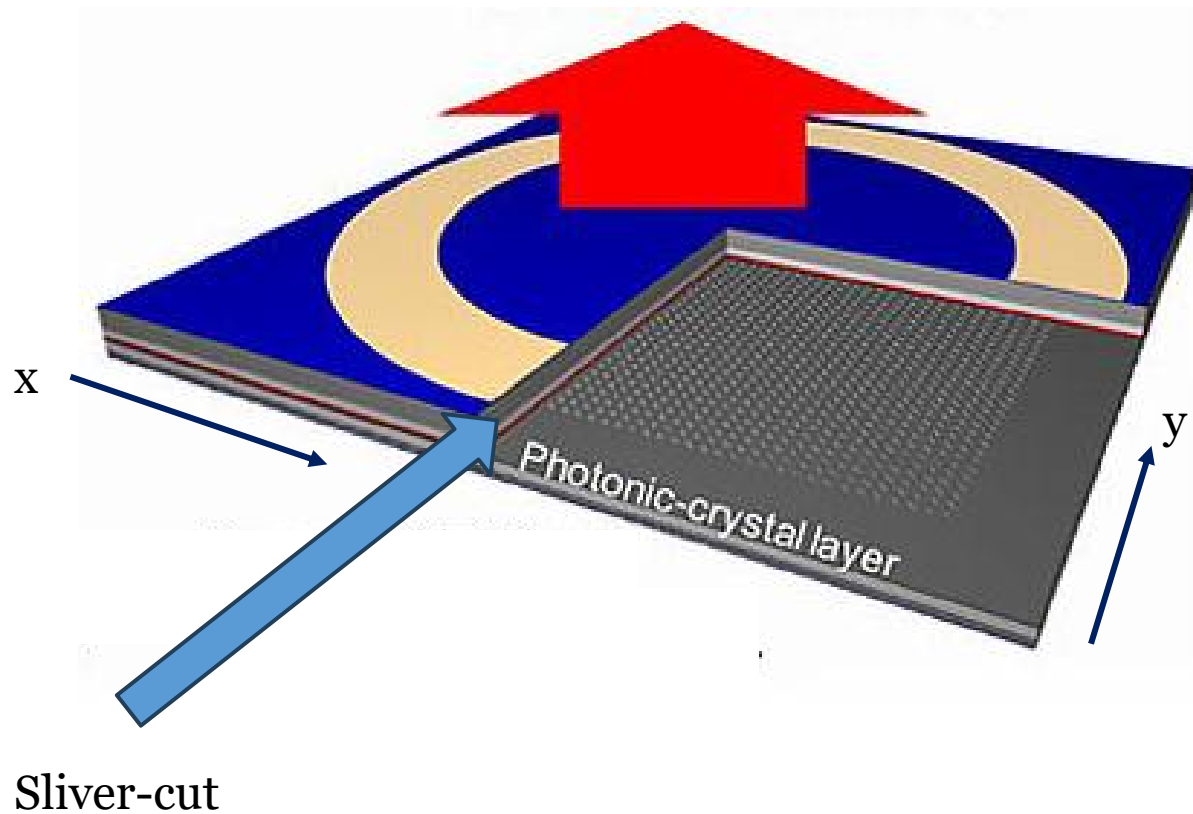
 3D PCSEL 仿真

 总结

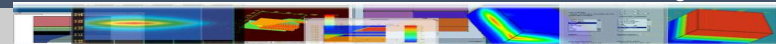
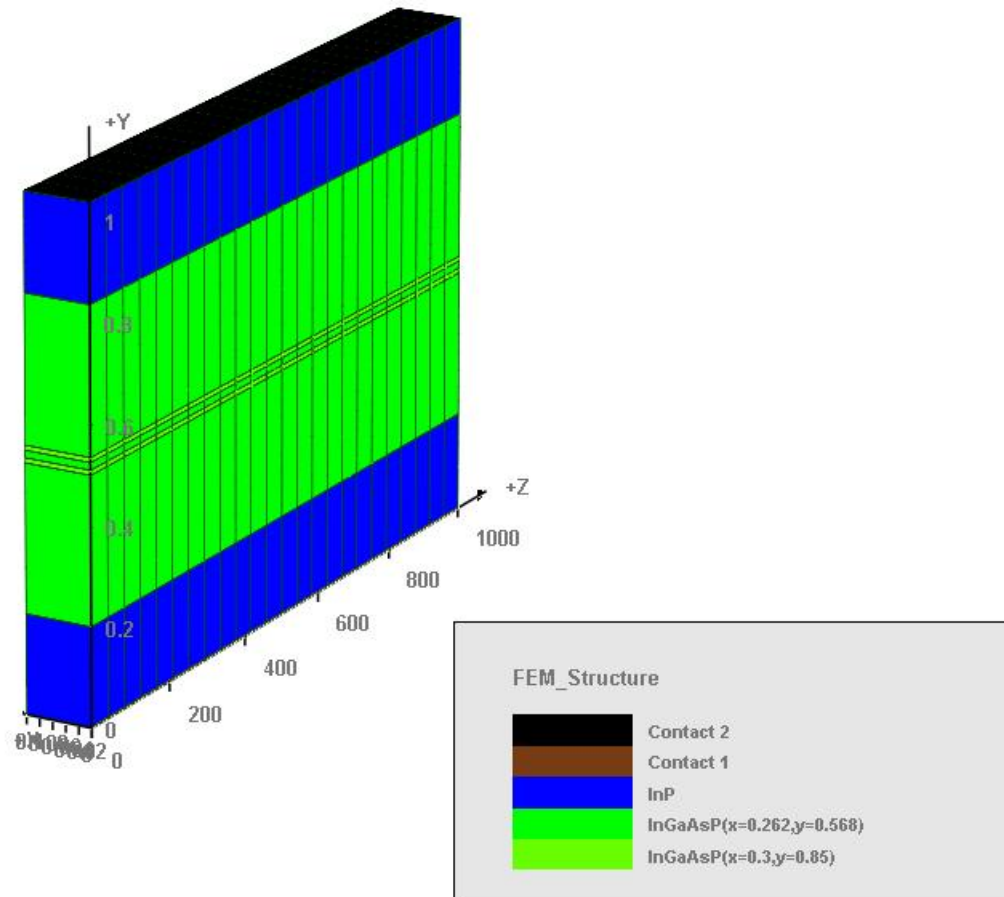




# 从3D PCSEL切取窄条

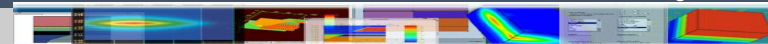
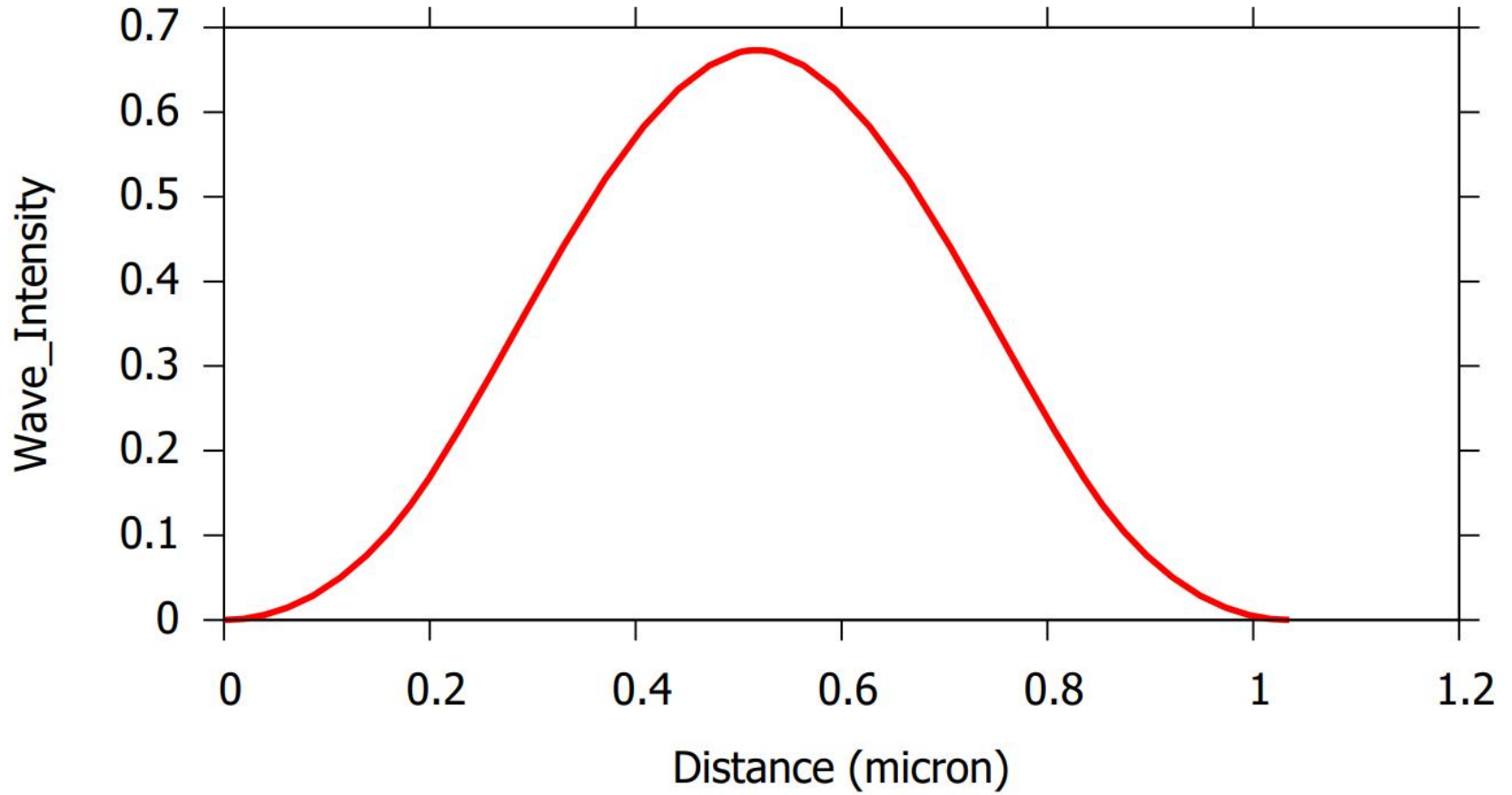


# 利用二阶DFB模型对窄条仿真

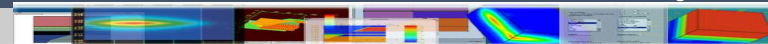
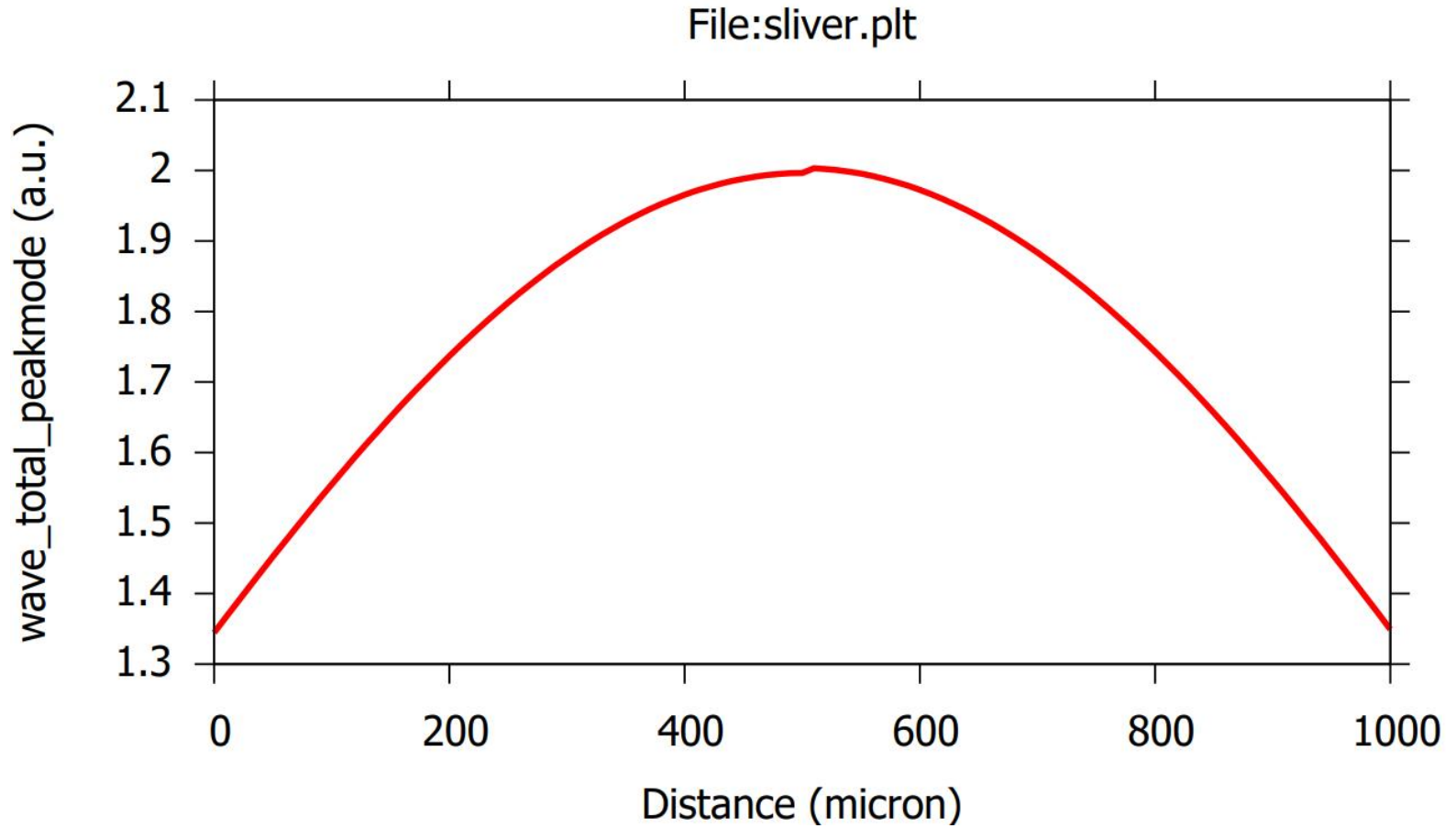


# 光波强度曲线 (垂直于窄条方向)

File:sliver.plt Gamma= 4.0979735E-02



# 光波强度曲线 (沿窄条方向)



# 目录

 简介

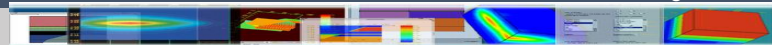
 光栅模型

 窄条近似

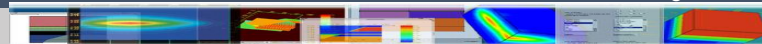
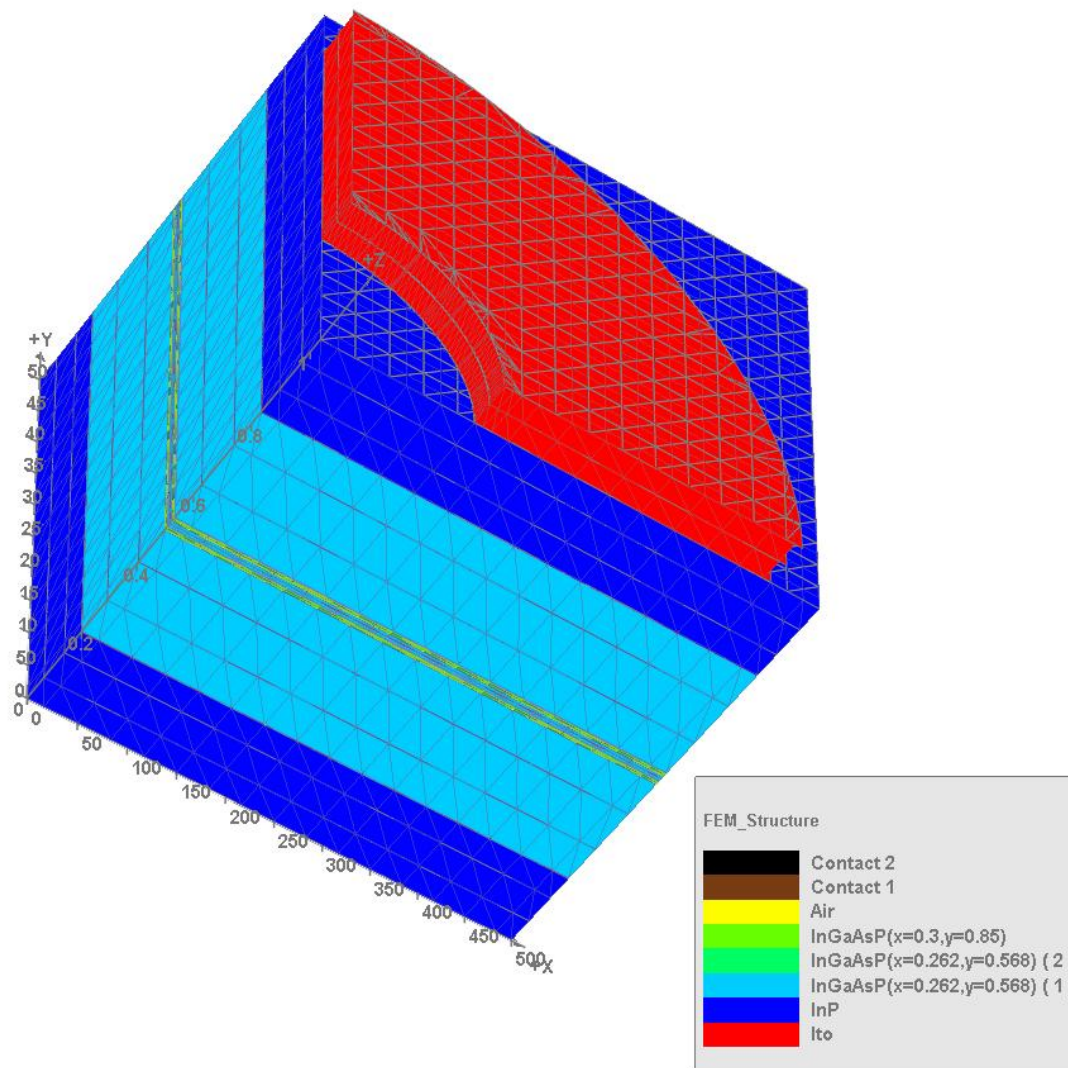


 3D PCSEL 仿真

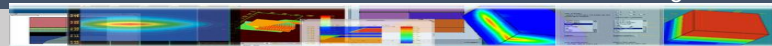
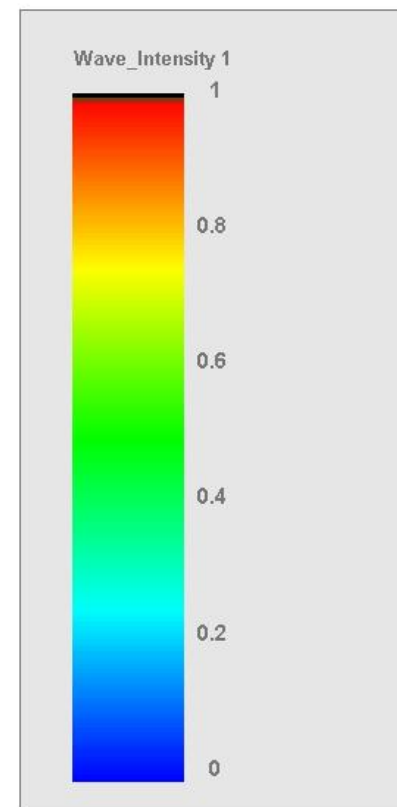
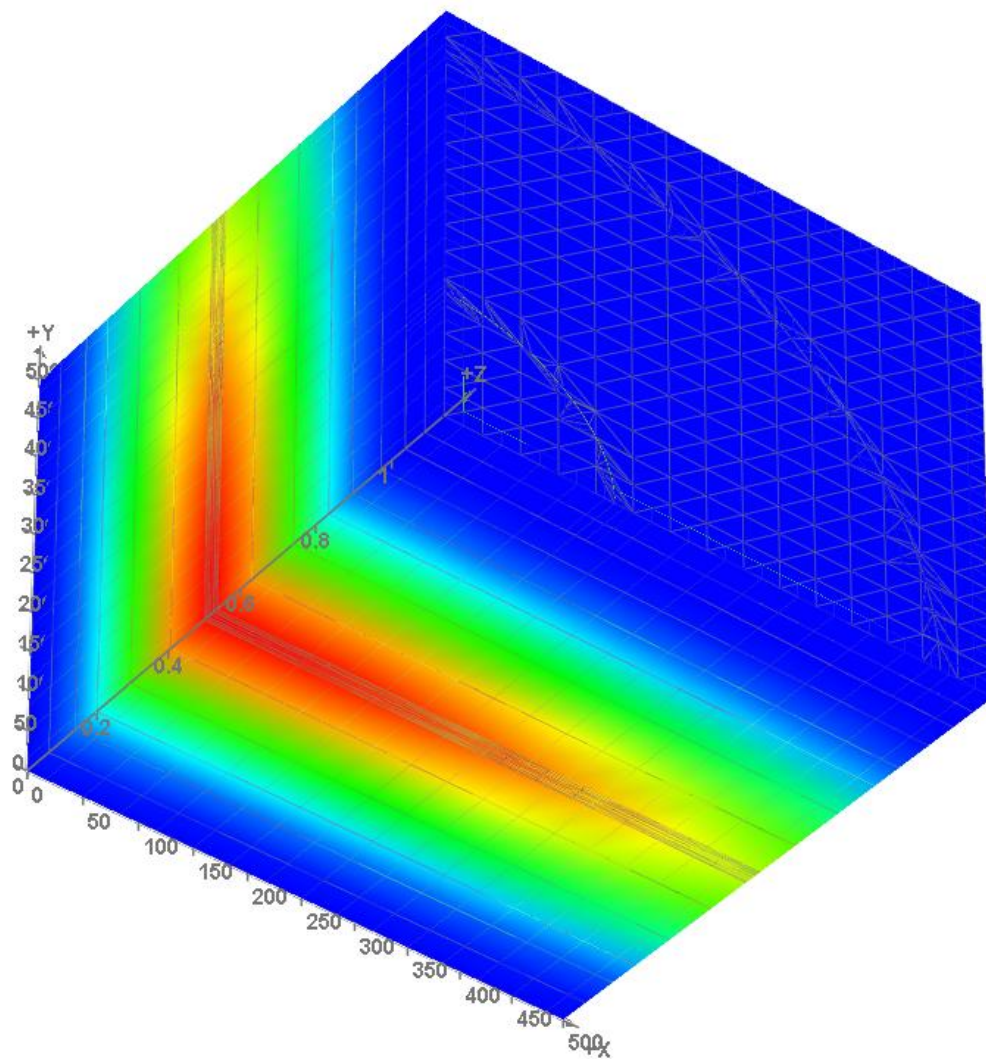
 总结



# 3D 结构 (PCSEL的1/4结构)

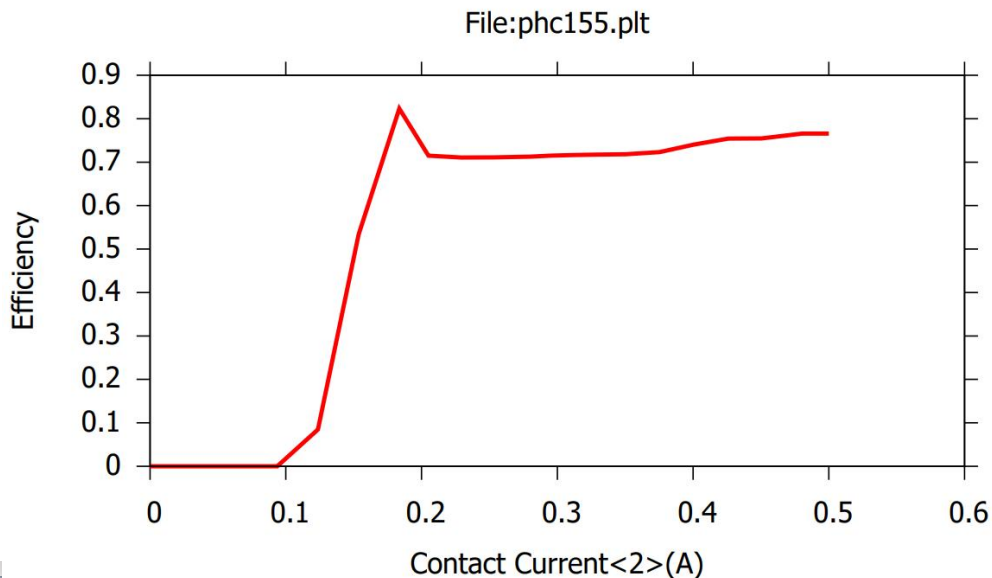
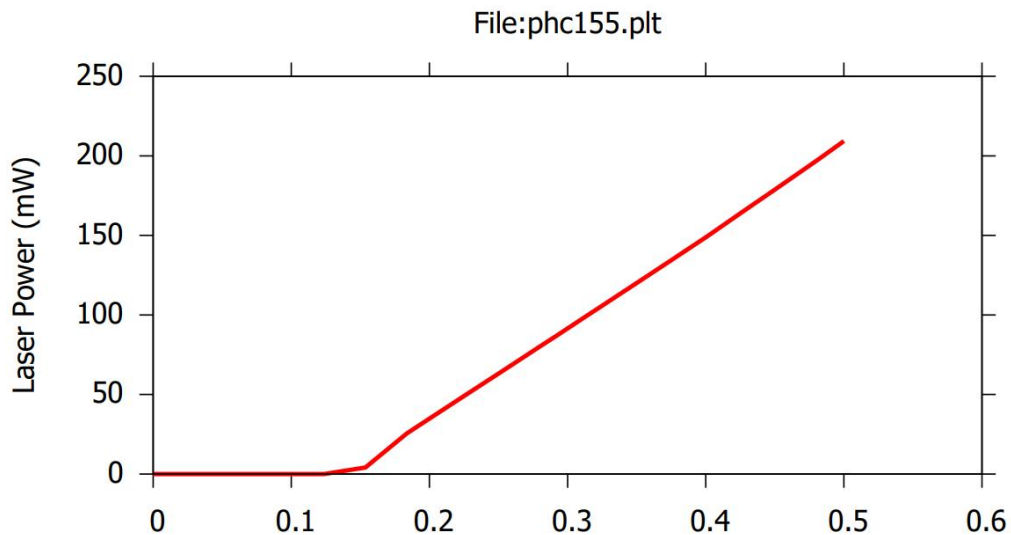


# 3D 光波强度 (PCSEL的1/4结构)

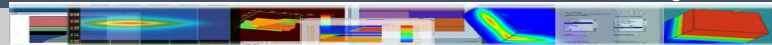




# 效率和功率 (PCSEL的1/4结构)

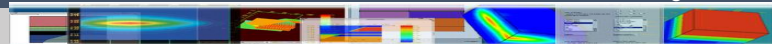
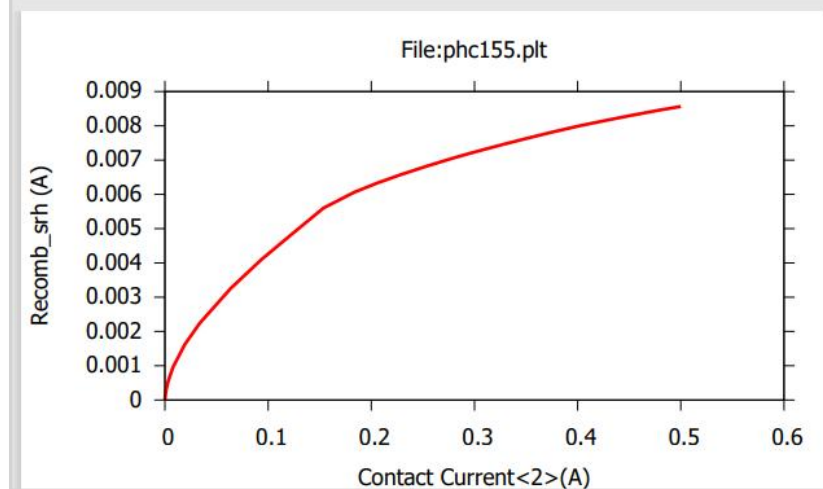
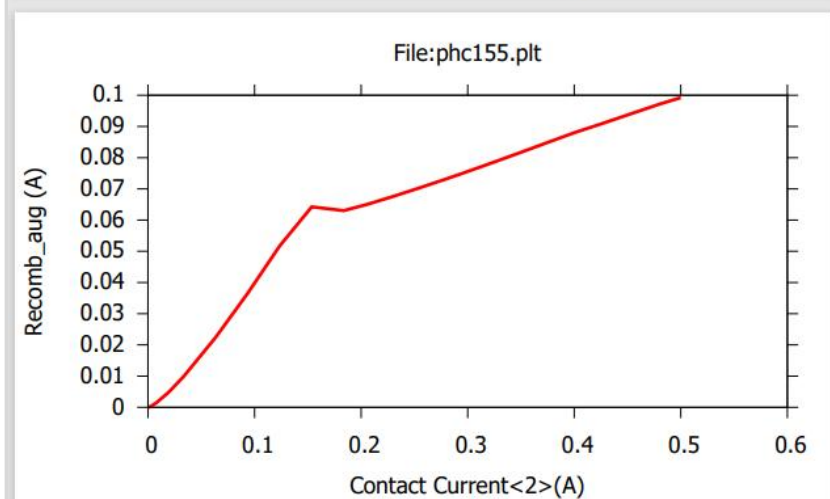
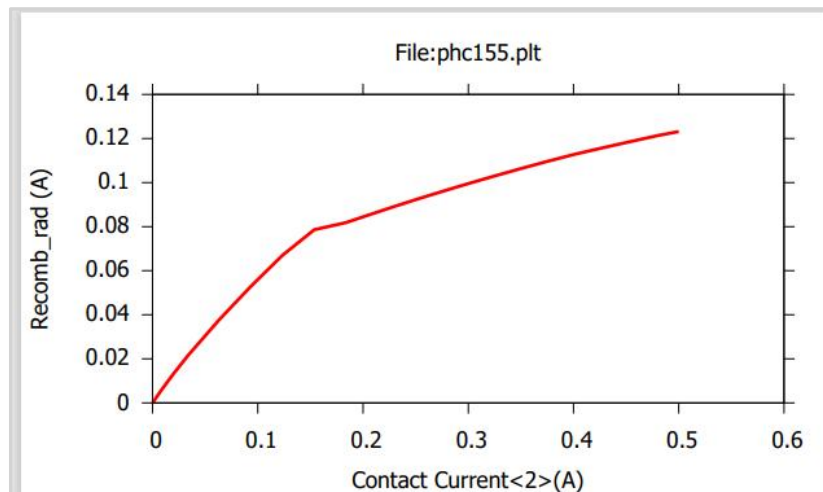
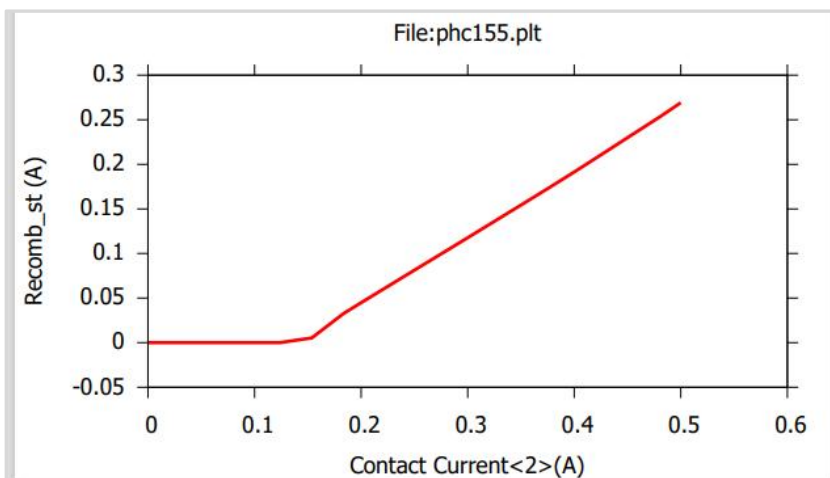


合适的设计可以获得更高的效率





# 多种注入分析 (PCSEL的1/4结构)



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 简介

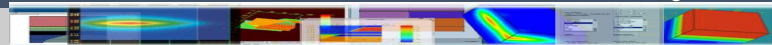
 光栅模型

 窄条近似





 3D PCSEL 仿真



 总结



# 总结

-  Crosslight 提供高效的 3D PCSEL 仿真工具  
(运行只需数分钟)
-  高度集成的多物理尺度模型，涵盖量子阱光学  
跃迁、电流注入/复合，直至数瓦级别光子发射
-  适用于电极优化、MQW 设计以及热分析
-  可在 Crosslight 2024 的测试版本中使用

