

```
In[*]:= Charting`$InteractiveHighlighting = False
Out[*]:=
False
```

---

## LASER dataset for the samples A, B, C, D and perovskite

```
In[*]:= titles = {"Sample A", "Sample B", "Sample C", "Sample D", "Perovskite"};
data =
  Dataset[Import[ToString@StringForm["/Users/giovannigravili/Library/Mobile
    Documents/com~apple~CloudDocs/LM
    MANO/Notebooks/NP/esperimento/LASER/laser_``.txt", #],
    "Table", "HeaderLines" → 0, "FieldSeparators" → "\t",
    "NumberPoint" → ".", CharacterEncoding → "UTF8"]][
  All, Range[1, 2]][All, <|"λ (nm)" → 1, "I" → 2|>] & /@
{"sample_A", "sample_B", "sample_C",
 "sample_D",
 "perovskite2"};

In[*]:= data = Transpose[{#[All, "λ (nm)"], #[All, "I"]} // Normal] & /@ data;

In[*]:= lamPk = FindPeaks[#, 100, Automatic, 0.1] & /@
  (TimeSeriesResample@TimeSeries[#2, {#1}] & @@@
    (Transpose[#] & /@ data)) // Normal;

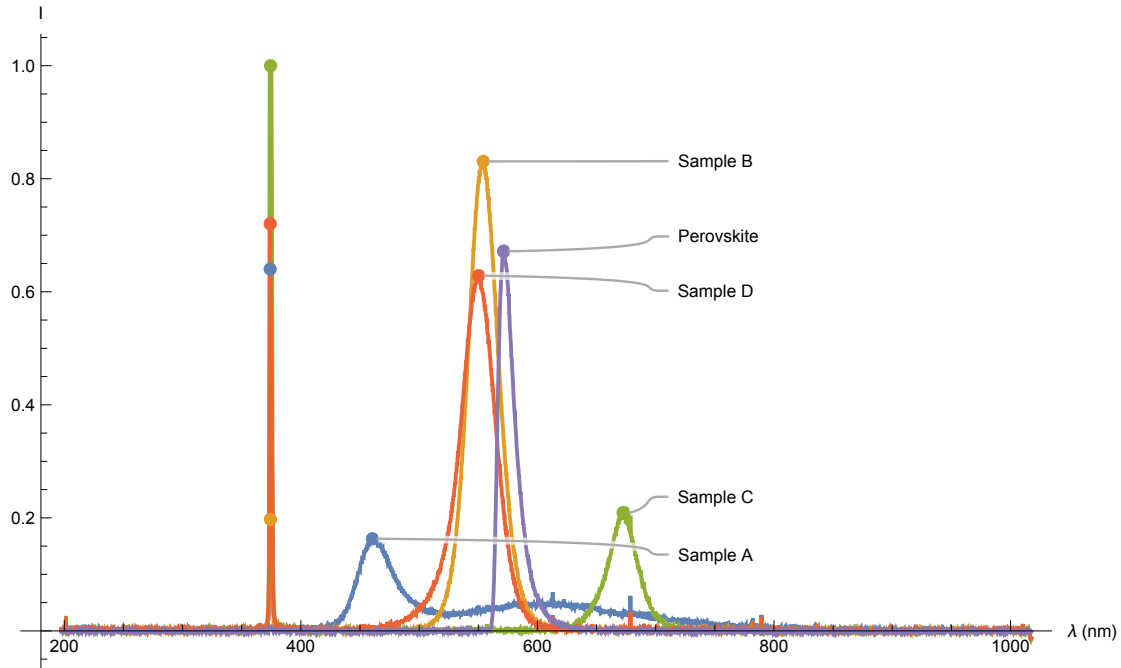
In[*]:= Rule @@@ Transpose[{titles, Column@Flatten@Take[#, All, 1] & /@ lamPk}] //
  Association // Dataset
Out[*]:=
```

Sample A	374.073 460.5
Sample B	374.278 554.3
Sample C	374.38 672.472 673.291
Sample D	374.073 550.409
Perovskite	571.504

```

In[*]:= ListLinePlot[data, PlotRange → All, AxesLabel → {"λ (nm)", "I"}] // Show[#,
ListPlot[lamPk, PlotLabels → titles], ImageSize → Large, PlotRange → All] &
Out[*]:=

```



```

In[*]:= lamIntervals = {{400, 530}, {500, 650}, {600, 750}, {450, 650}, {550, 650}};
valsInt =
Cases[#1, {x_, y_} /; #2[[1]] ≤ x ≤ #2[[2]]] &@@@ Transpose[{data, lamIntervals}];

```

```

In[*]:= fitFn = NonlinearModelFit[#1, A e-(λ-μ)2 / (2 σ2), {A, {μ, #2}, σ}, λ] &@@@
Transpose[{valsInt, {460.5, 554.3, 672.47, 550.4, 571.5}}];

```

```

In[*]:= {Show[Plot[#1[λ], {λ, #3[[1]], #3[[2]]}, ImageSize → Medium, PlotLabel → #4],
ListPlot[#2, PlotStyle → {Orange, PointSize[Small]}], PlotRange → All],
Column[{#1["ANOVATable"], "", #1["ParameterTable"]}]} &@@@
Transpose[{fitFn, valsInt, lamIntervals, titles}] // TableForm

```

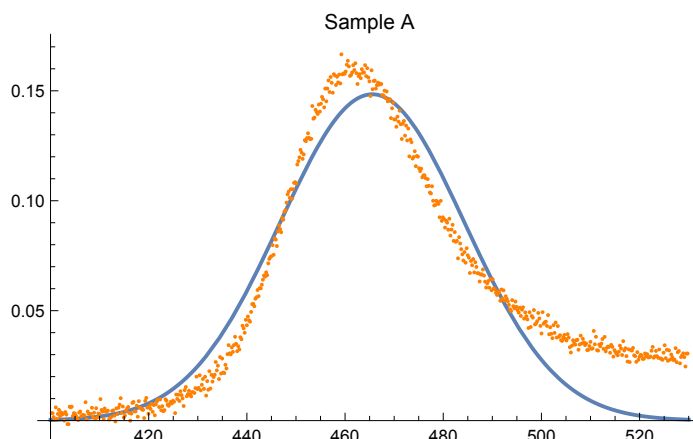
General : Exp[−828.781] is too small to represent as a normalized machine number; precision may be lost. ⓘ

General : Exp[−2613.35] is too small to represent as a normalized machine number; precision may be lost. ⓘ

General : Exp[−750.007] is too small to represent as a normalized machine number; precision may be lost. ⓘ

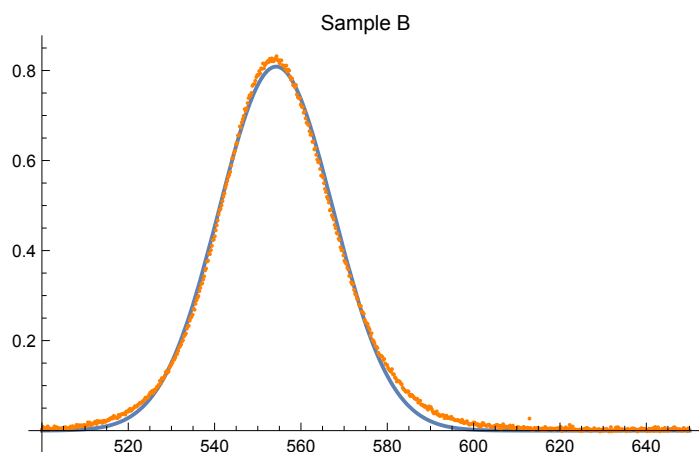
General : Further output of General::munfl will be suppressed during this calculation. ⓘ

Out[\*] // TableForm =



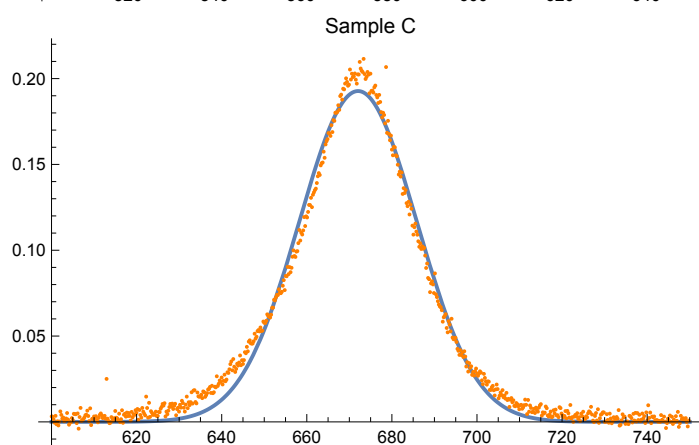
	DF	SS	MS
Model	3	3.33954	1.11318
Error	588	0.142996	0.00024319
Uncorrected Total	591	3.48254	
Corrected Total	590	1.47775	

	Estimate	Standard Error	t-Statistic	P-Value
A	0.148411	0.00155118	95.6765	0.
μ	465.551	0.226788	2052.8	0.
σ	18.7921	0.226815	82.8519	0.



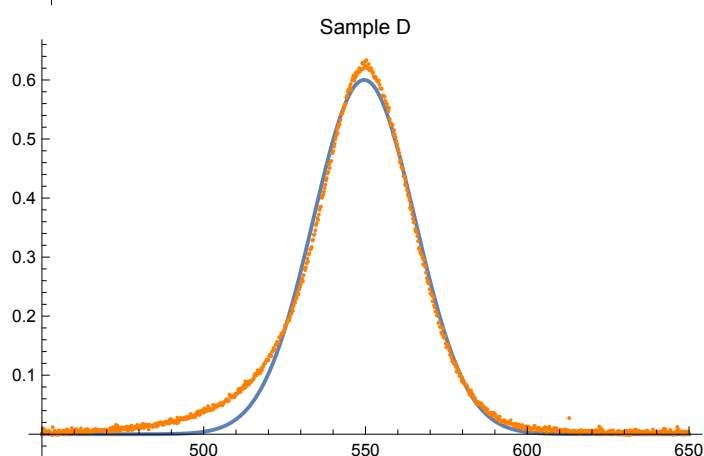
	DF	SS	MS
Model	3	68.4555	22.8185
Error	664	0.122707	0.000184799
Uncorrected Total	667	68.5782	
Corrected Total	666	45.7676	

	Estimate	Standard Error	t-Statistic	P-Value
A	0.808636	0.00162721	496.945	0.
$\mu$	554.26	0.0307381	18031.7	0.
$\sigma$	13.2287	0.0307377	430.374	0.



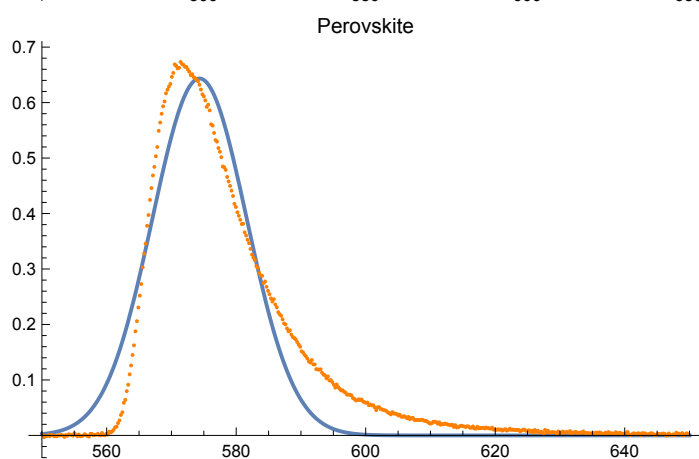
	DF	SS	MS
Model	3	3.95992	1.31997
Error	651	0.0298337	0.0000458
Uncorrected Total	654	3.98976	
Corrected Total	653	2.54211	

	Estimate	Standard Error	t-Statistic	P-Value
A	0.192741	0.000803042	240.013	0.
$\mu$	672.052	0.0663241	10132.9	0.
$\sigma$	13.786	0.0663233	207.861	0.



	DF	SS	MS
Model	3	44.8615	14.9538
Error	891	0.282091	0.0003166
Uncorrected Total	894	45.1436	
Corrected Total	893	30.961	

	Estimate	Standard Error	t-Statistic	P-Value
A	0.600014	0.00195221	307.352	0.
$\mu$	549.599	0.0590979	9299.8	0.
$\sigma$	15.7305	0.0590969	266.181	0.



	DF	SS	MS
Model	3	23.804	7.93468
Error	439	1.16107	0.0026448
Uncorrected Total	442	24.9651	
Corrected Total	441	17.4937	

	Estimate	Standard Error	t-Statistic	P-Value
A	0.643393	0.00830639	77.4576	3.8531e-14
$\mu$	574.345	0.10877	5280.35	0.
$\sigma$	7.29657	0.108786	67.0728	7.7907e-12

## UV dataset for the samples A, B, C, D

```

In[*]:= titles = {"Sample A", "Sample B", "Sample C", "Sample D"};
data =
  Dataset[Import[ToString@StringForm["/Users/giovannigravili/Library/Mobile
    Documents/com~apple~CloudDocs/LM
    MANO/Notebooks/NP/esperimento/uvNewCorrect/sample`.txt",
    #], "Table", "HeaderLines" → 0, "FieldSeparators" → "\t",
    "NumberPoint" → ".", CharacterEncoding → "UTF8"]][All, Range[1, 2]][
  All, <|"λ (nm)" → 1, "I" → 2|>] & /@ {"A", "B", "C", "D"};

In[*]:= data = Transpose[{#[All, "λ (nm)"], #[All, "I"]} // Normal] & /@ data;

In[*]:= lamPk = FindPeaks[#, 50, Automatic, 0.05] & /@
  (TimeSeriesResample@TimeSeries[#2, {#1}] & @@@
    (Transpose[#] & /@ data)) // Normal;

In[*]:= Rule @@@ Transpose[{titles, Column@Flatten@Take[#, All, 1] & /@ lamPk}] //
  Association // Dataset

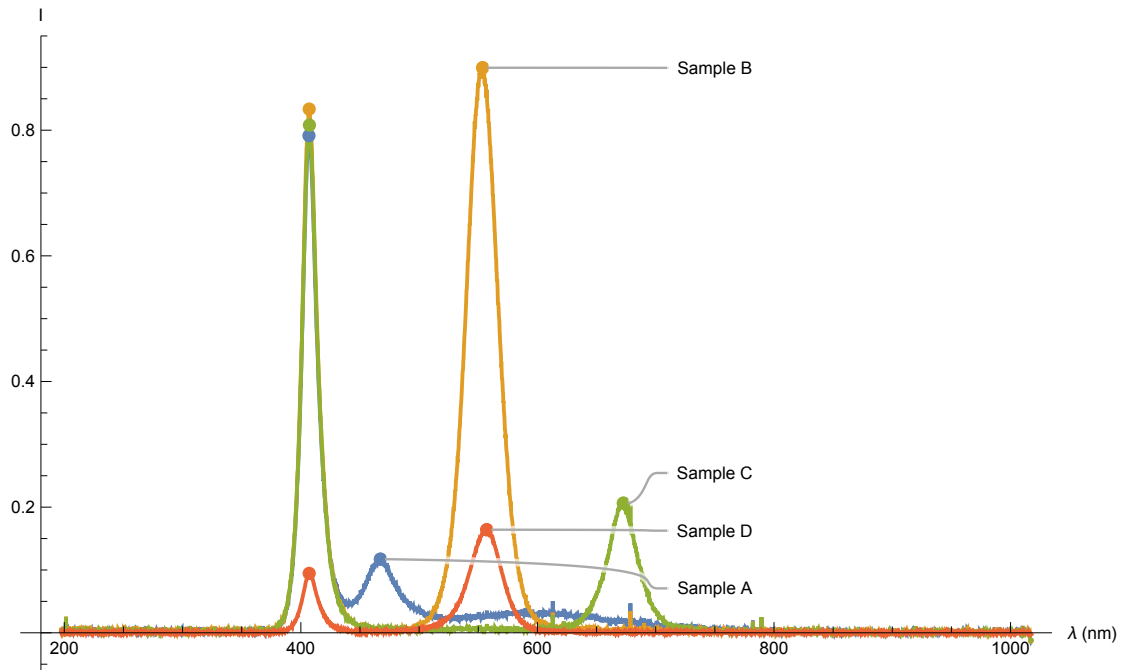
Out[*]:=

```

Sample A	406.842 467.259
Sample B	407.046 553.686
Sample C	407.251 672.677
Sample D	407.046 557.167

```
In[*]:= ListLinePlot[data, PlotRange → All, AxesLabel → {"λ (nm)", "I"}] // Show[#,
  ListPlot[lamPk, PlotLabels → titles], ImageSize → Large, PlotRange → All] &
```

Out[\*]=



```
In[*]:= lamIntervals = {{440, 500}, {480, 650}, {600, 750}, {500, 650}};
valsInt =
  Cases[#1, {x_, y_} /; #2[[1]] ≤ x ≤ #2[[2]]] &@@@Transpose[{data, lamIntervals}];
```

```
In[*]:= fitFn = NonlinearModelFit[#1, A e-((λ-μ)2/(2 σ2)), {A, {μ, #2}, σ}, λ] &@@@
  Transpose[{valsInt, {467.25, 553.68, 672.47, 557.4}}]
```

Out[\*]=

```
{FittedModel[0.106529 e-0.00153351 (<<1>>)2], FittedModel[0.875347 e-0.00256873 (<<1>>)2],
  FittedModel[0.191232 e-0.00237737 (<<1>>)2], FittedModel[0.157592 e-0.00236518 (<<1>>)2]}
```

```
In[*]:= {Show[Plot[#1[λ], {λ, #3[[1]], #3[[2]]}, ImageSize → Medium, PlotLabel → #4],
  ListPlot[#2, PlotStyle → {Orange, PointSize[Small]}], PlotRange → All],
  Column[{#1["ANOVATable"], "", #1["ParameterTable"]}]} &@@@
  Transpose[{fitFn, valsInt, lamIntervals, titles}] // TableForm
```

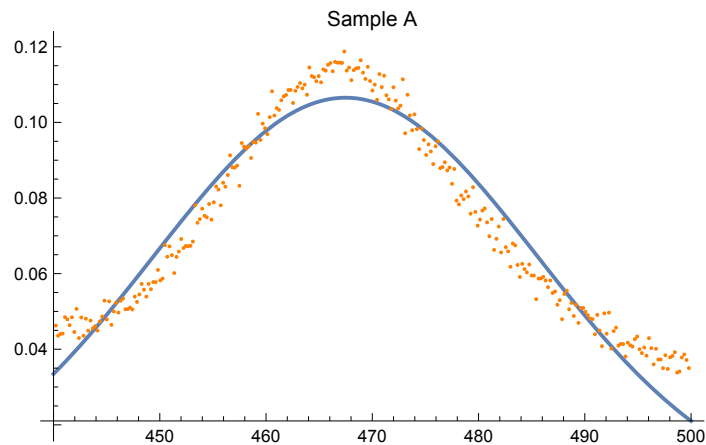
General : Exp[−1422.88] is too small to represent as a normalized machine number; precision may be lost.

General : Exp[−2189.75] is too small to represent as a normalized machine number; precision may be lost.

General : Exp[−4855.1] is too small to represent as a normalized machine number; precision may be lost.

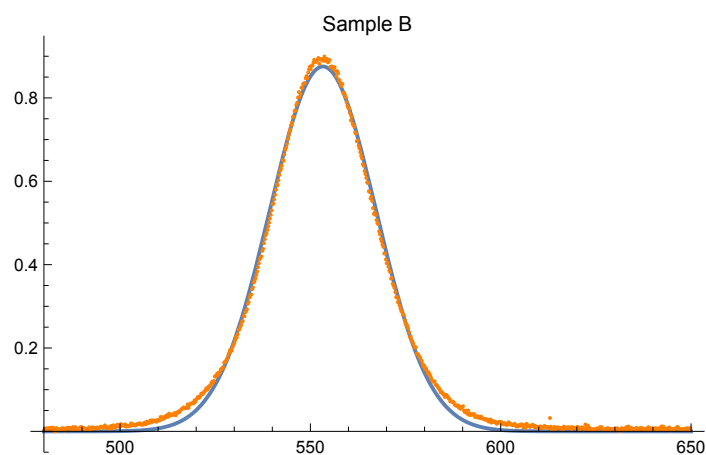
General : Further output of General::munfl will be suppressed during this calculation.

Out[ ]//TableForm=



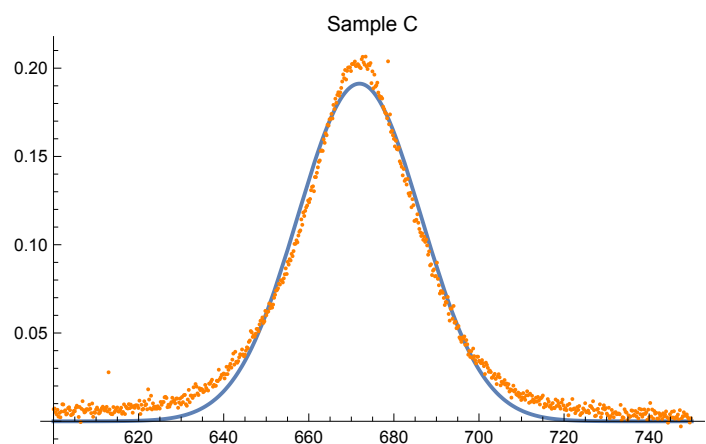
	DF	SS	MS
Model	3	1.61686	0.538954
Error	269	0.0121337	0.00004510
Uncorrected Total	272	1.629	
Corrected Total	271	0.182624	

	Estimate	Standard Error	t-Statistic	P-	Value
A	0.106529	0.000721465	147.656	1.7627	
$\mu$	467.477	0.145401	3215.09	0.	
$\sigma$	18.0569	0.176268	102.44	1.5823	



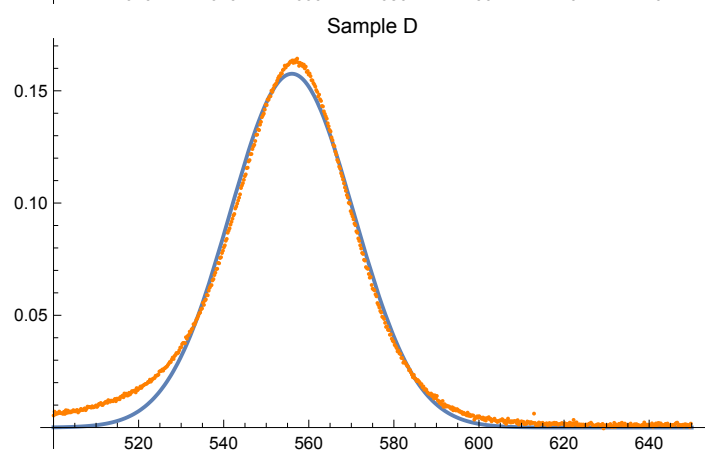
	DF	SS	MS
Model	3	84.6172	28.2057
Error	754	0.171484	0.000227432
Uncorrected Total	757	84.7887	
Corrected Total	756	57.893	

	Estimate	Standard Error	t-Statistic	P-	Value
A	0.875347	0.00175761	498.033	0.	
$\mu$	553.295	0.0323471	17104.9	0.	
$\sigma$	13.9517	0.0323466	431.317	0.	



	DF	SS	MS
Model	3	4.10082	1.36694
Error	651	0.039738	0.00006104
Uncorrected Total	654	4.14056	
Corrected Total	653	2.48463	

	Estimate	Standard Error	t-Statistic	P-	Value
A	0.191232	0.000903615	211.63	0.	
$\mu$	671.905	0.0791273	8491.44	0.	
$\sigma$	14.5023	0.0791263	183.28	0.	



	DF	SS	MS
Model	3	2.85658	0.952194
Error	664	0.0145978	0.00002196
Uncorrected Total	667	2.87118	
Corrected Total	666	1.77811	

	Estimate	Standard Error	t-Statistic	P-	Value
A	0.157592	0.000535448	294.318	0.	
$\mu$	556.035	0.057043	9747.66	0.	
$\sigma$	14.5396	0.0570424	254.891	0.	

```
In[*]:= selVal = Cases[First@data, {x_, y_} /; 300 ≤ x ≤ 900];
```

```
In[*]:= fiti = NonlinearModelFit[selVal, A1 e- $\frac{(\lambda-\mu_1)^2}{2\sigma_1^2}$  + A2 e- $\frac{(\lambda-\mu_2)^2}{2\sigma_2^2}$  + A3 e- $\frac{(\lambda-\mu_3)^2}{2\sigma_3^2}$ ,  
{A1, {μ1, 406}, σ1, A2, {μ2, 467.25}, σ2, A3, {μ3, 600}, σ3}, λ];
```

```
In[*]:= {Show[Plot[fiti[λ], {λ, 300, 900},  
ImageSize → Large, PlotRange → All, PlotLabel → "Sample A",  
ListPlot[selVal, PlotStyle → {Orange, PointSize[Small]}], PlotRange → All],  
Column[{fiti["ANOVATable"], "", fiti["ParameterTable"]}]} // TableForm
```

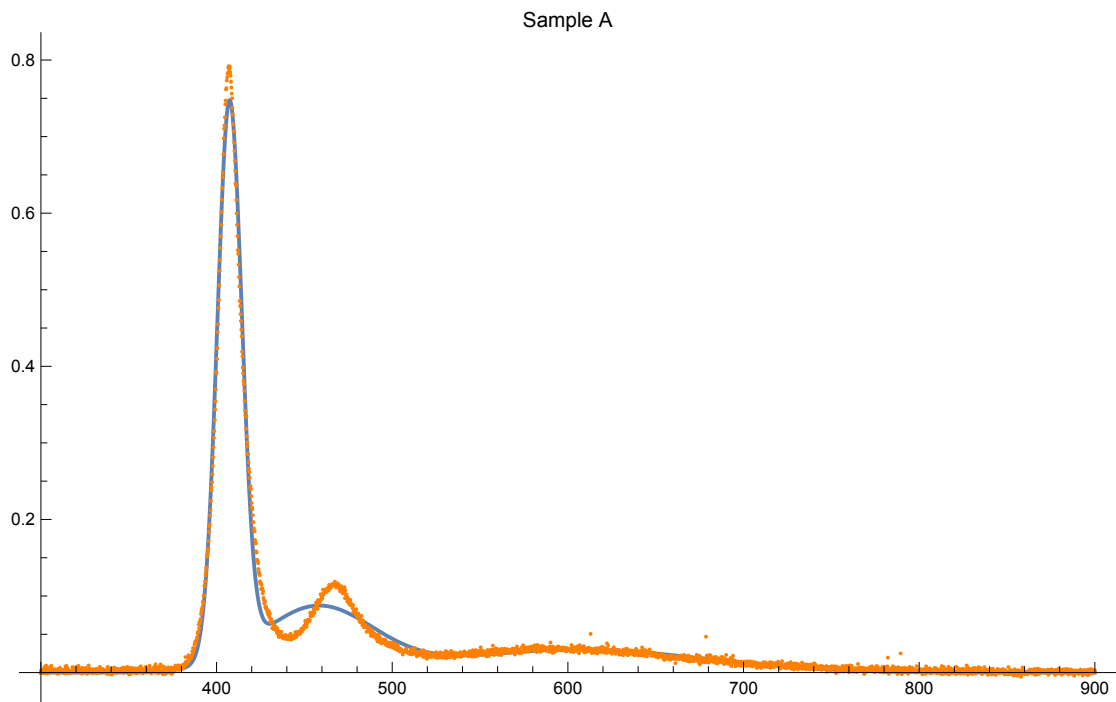
General :  $0.721808 \cdot 2.52765 \times 10^{-308}$  is too small to represent as a normalized machine number; precision may be lost. [i](#)

General :  $\text{Exp}[-709.51]$  is too small to represent as a normalized machine number; precision may be lost. [i](#)

General :  $\text{Exp}[-710.752]$  is too small to represent as a normalized machine number; precision may be lost. [i](#)

General : Further output of General::munfl will be suppressed during this calculation. [i](#)

Out[\*] // TableForm =



	DF	SS	MS
Model	9	35.2949	3.92165
Error	2655	0.31184	0.000117454
Uncorrected Total	2664	35.6067	
Corrected Total	2663	30.6546	

	Estimate	Standard Error	t-Statistic	P-Value
A <sub>1</sub>	0.721808	0.0020422	353.446	0.
μ <sub>1</sub>	407.373	0.0199268	20443.5	0.
σ <sub>1</sub>	6.95133	0.0245919	282.668	0.
A <sub>2</sub>	0.0842021	0.000954082	88.2545	0.
μ <sub>2</sub>	457.219	0.520148	879.017	0.
σ <sub>2</sub>	32.0018	0.635717	50.3396	0.
A <sub>3</sub>	0.0301523	0.000588465	51.2389	0.
μ <sub>3</sub>	606.328	2.20443	275.05	0.
σ <sub>3</sub>	70.8791	2.38818	29.6792	2.04606 × 10 <sup>-167</sup>

## Green, red and UV LEDs spectra

```

In[ ]:= titles = {"Green LED", "Red LED", "UV LED"};
data =
  Dataset[Import[ToString@StringForm["/Users/giovannigravili/Library/Mobile
    Documents/com~apple~CloudDocs/LM
    MANO/Notebooks/NP/esperimento/LEDs/`LedTxt.txt", #],
    "Table", "HeaderLines" → 0, "FieldSeparators" → "\t",
    "NumberPoint" → ".", CharacterEncoding → "UTF8"]][All, Range[1, 2]][
  All, <|"λ (nm)" → 1, "I" → 2|>] & /@ {"green", "red", "uv"};

In[ ]:= data = Transpose[{#[All, "λ (nm)"], #[All, "I"]} // Normal] & /@ data;

In[ ]:= lamPk = FindPeaks[#, 100, Automatic, 0.05] & /@
  (TimeSeriesResample@TimeSeries[#2, {#1}] & @@@
    (Transpose[#] & /@ data)) // Normal;

In[ ]:= Rule @@@ Transpose[{titles, Column@Flatten@Take[#, All, 1] & /@ lamPk}] //
  Association // Dataset

```

Out[ ]:=

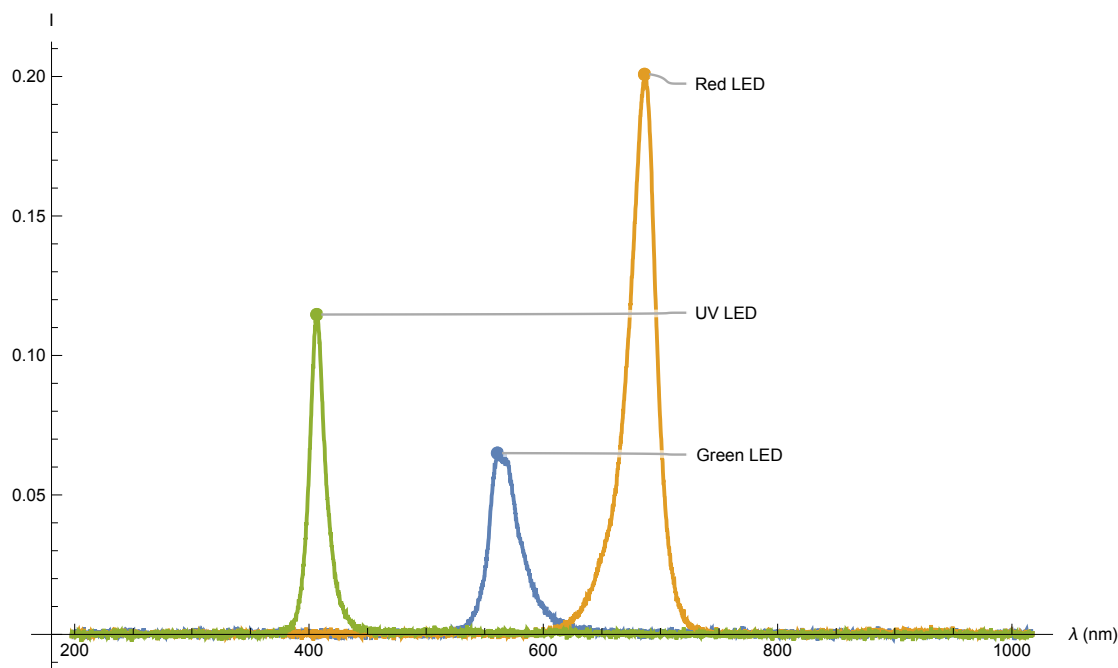
Green LED	560.854
Red LED	686.398
UV LED	406.637

```

In[ ]:= ListLinePlot[data, PlotRange → All, AxesLabel → {"λ (nm)", "I"}] // Show[#,
  ListPlot[lamPk, PlotLabels → titles], ImageSize → Large, PlotRange → All] &

```

Out[ ]:=





```

In[*]:= lamIntervals = {{500, 650}, {580, 800}, {360, 450}};
valsInt =
  Cases[#1, {x_, y_} /; #2[[1]] ≤ x ≤ #2[[2]]] &@@@ Transpose[{data, lamIntervals}];

In[*]:= fitFn = NonlinearModelFit[#1, A e- $\frac{(\lambda-\mu)^2}{2\sigma^2}$ , {A, {μ, #2}, σ}, λ] &@@@
  Transpose[{valsInt, {560.9, 686.4, 406.6}}]

Out[*]=
{ FittedModel[ $0.0623024 e^{-0.00275522 (\ll 1 \gg)^2}$ ],
  FittedModel[ $0.183749 e^{-0.00299913 (\ll 1 \gg)^2}$ ], FittedModel[ $0.10579 e^{-0.00947149 (\ll 1 \gg)^2}$ ] ] }

```

```

In[*]:= {Show[Plot[#1[λ], {λ, #3[[1]], #3[[2]]}, ImageSize → Medium, PlotLabel → #4],
  ListPlot[#2, PlotStyle → {Orange, PointSize[Small]}], PlotRange → All],
  Column[{#1["ANOVATable"], "", #1["ParameterTable"]}]} &@@@
Transpose[{fitFn, valsInt, lamIntervals, titles}] // TableForm

```

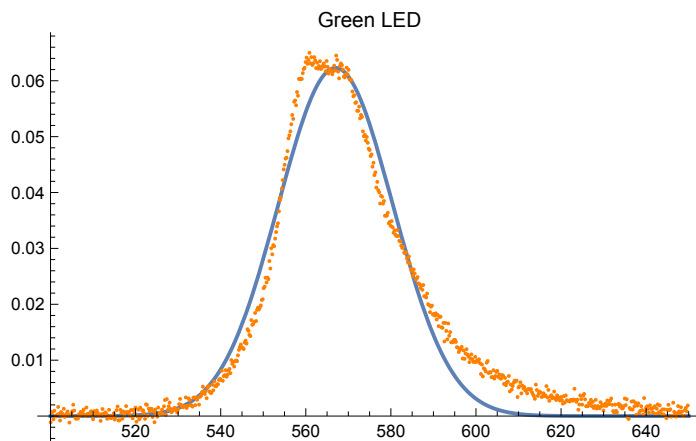
General : Exp[−1155.2] is too small to represent as a normalized machine number; precision may be lost.

General : Exp[−3532.45] is too small to represent as a normalized machine number; precision may be lost.

General : Exp[−1063.13] is too small to represent as a normalized machine number; precision may be lost.

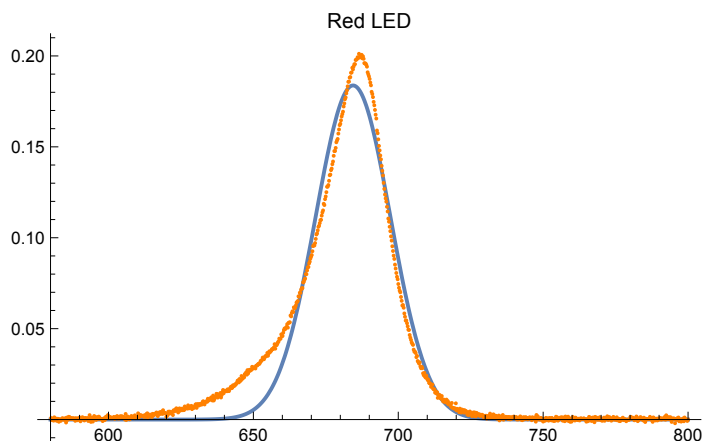
General : Further output of General::munfl will be suppressed during this calculation.

Out[\*] // TableForm =



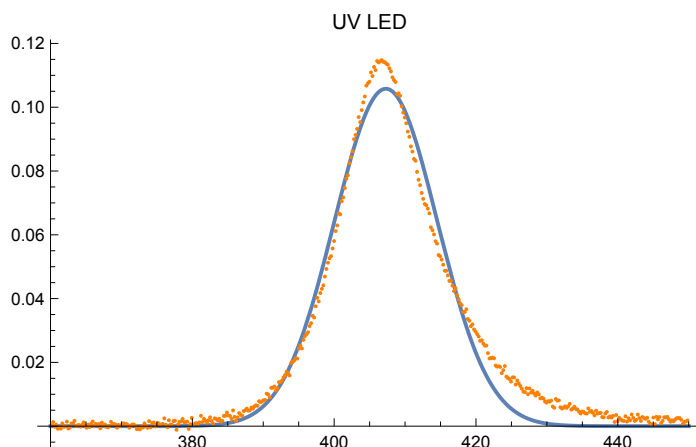
	DF	SS	MS
Model	3	0.412719	0.137573
Error	664	0.00884482	0.000013
Uncorrected Total	667	0.421563	
Corrected Total	666	0.26772	

	Estimate	Standard Error	t-Statistic	P-Value
A	0.0623024	0.000433495	143.721	0.
$\mu$	567.	0.108231	5238.78	0.
$\sigma$	13.4712	0.10823	124.469	0.



	DF	SS	MS
Model	3	3.36313	1.12104
Error	954	0.0776968	0.0000814
Uncorrected Total	957	3.44083	
Corrected Total	956	2.59732	

	Estimate	Standard Error	t-Statistic	P-Value
A	0.183749	0.00110745	165.92	0.
$\mu$	684.39	0.0898578	7616.37	0.
$\sigma$	12.9118	0.0898569	143.693	0.



	DF	SS	MS
Model	3	0.665053	0.221684
Error	412	0.00903571	0.0000219
Uncorrected Total	415	0.674089	
Corrected Total	414	0.451651	

	Estimate	Standard Error	t-Statistic	P-Value
A	0.10579	0.000744038	142.184	0.
$\mu$	407.296	0.0590058	6902.65	0.
$\sigma$	7.26567	0.0590055	123.136	0.