

Academic Skills
Presentation Skills

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Why Do You Have to Give Talks?

Academic career:

clear and concise scientific narrative

- ✓ Scientific research
- ✓ Teaching



Industrial career:

short presentation – a basis for any management

- ✓ what has been achieved
- ✓ short synopsis for the future plans



Remember

**Failed 5-minute presentation might destroy
months of team work**

Scientific Talk's Pitfalls

- ✓ diverse audience
- ✓ strict and tough time limits
- ✓ a lot of info to convey
- ✓ anxiety, nervousness, unease

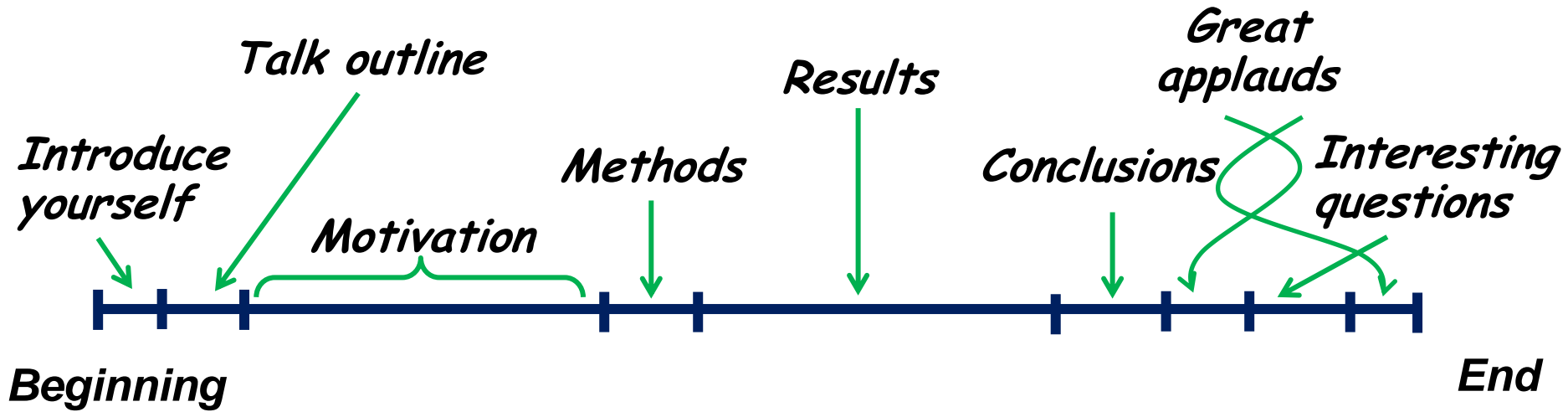
Few reasons of a bad talk

- ✗ Inability to motivate the audience
- ✗ Chaotic structure
- ✗ Loopholes in the logics
- ✗ Too many details
- ✗ Unstructured slides
- ✗ Bad way of presenting
- ✗ There're 100's more of them

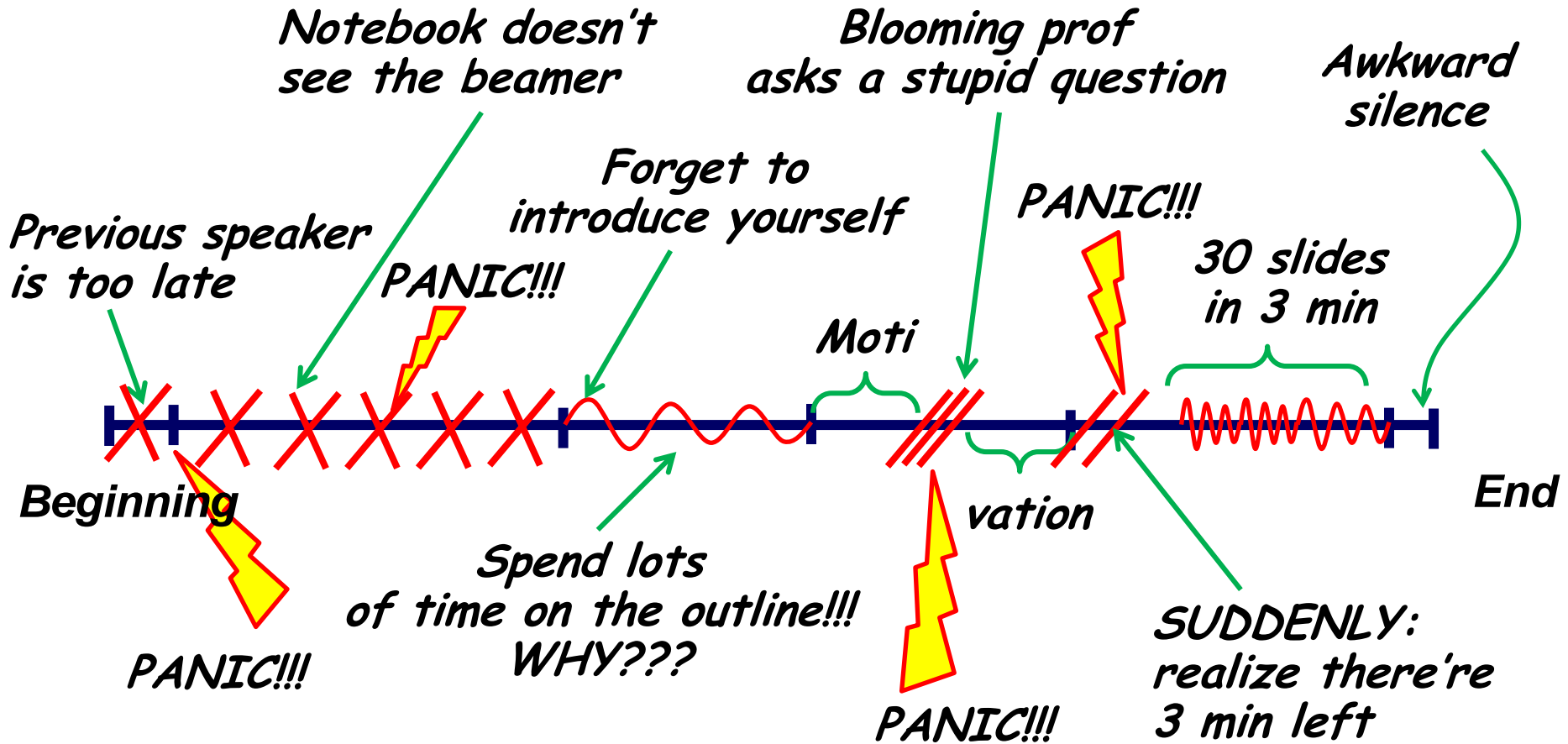
Every kid knows the scientific approach



Your Dream of Your Presentation



...and Harsh Reality

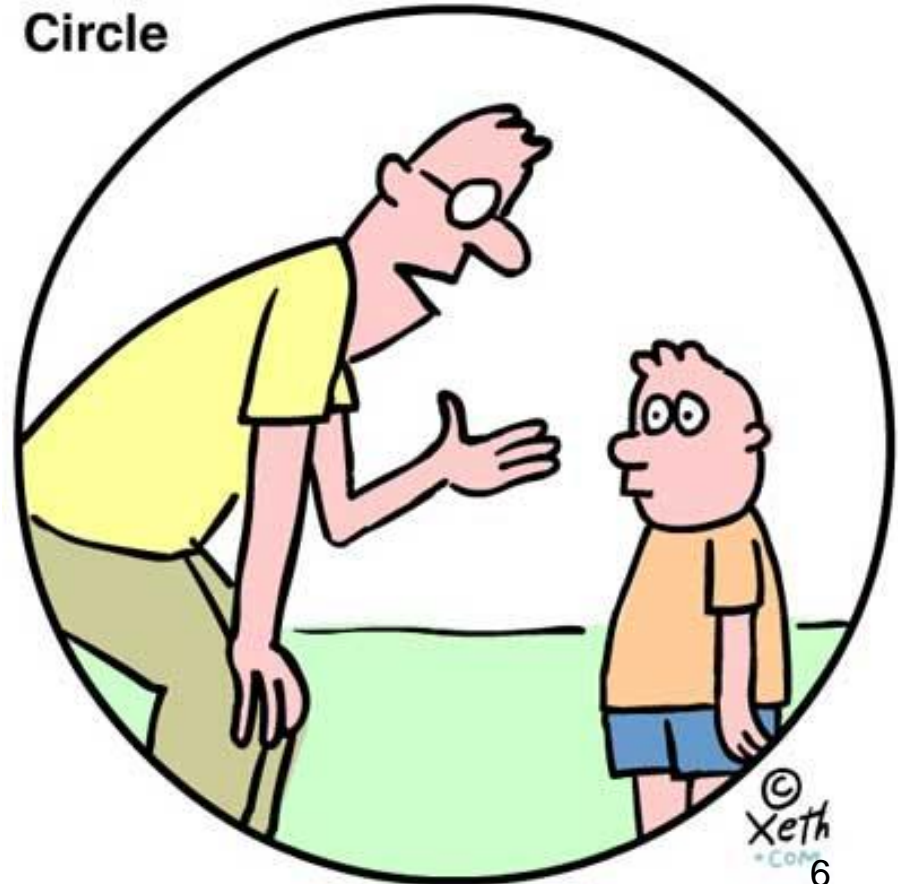


Goal of This Course

Algorithms, tips, and errors
in preparation of and during a scientific talk

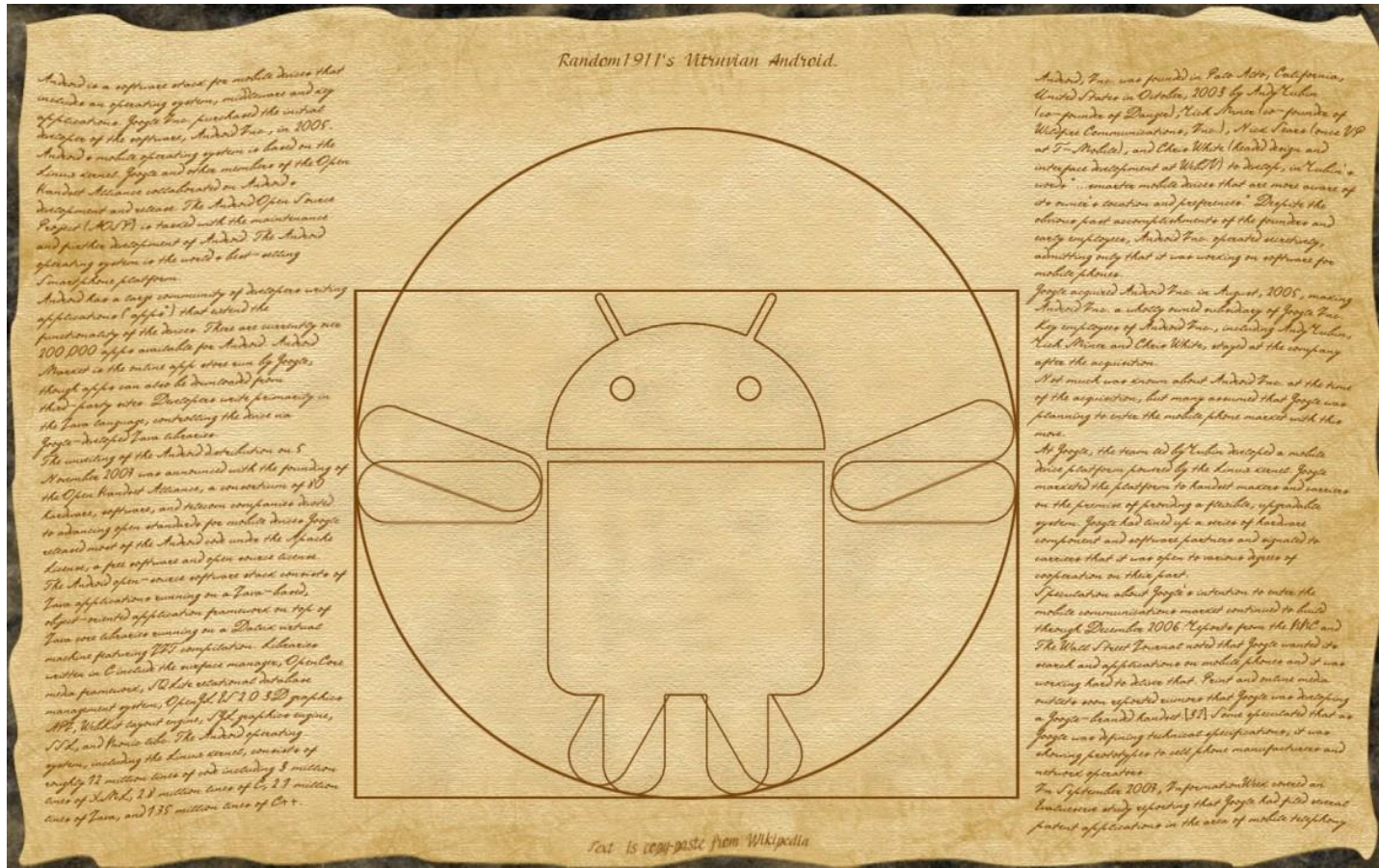
«The important thing is you tried.
You tried and you failed.
And you failed BIG.
That's what's important.
You're a big failure
who tried and failed.»

The Uncomfortable
Circle



«Dont's» of This Talk

- ✗ No presentation for the job interview
- ✗ No examples of the bad/good talks
- ✗ No explanation of the cartoons
- ✗ No war-starting discussions



1. Getting Started

Trivial: you must have the subject of the talk
(scientific results)

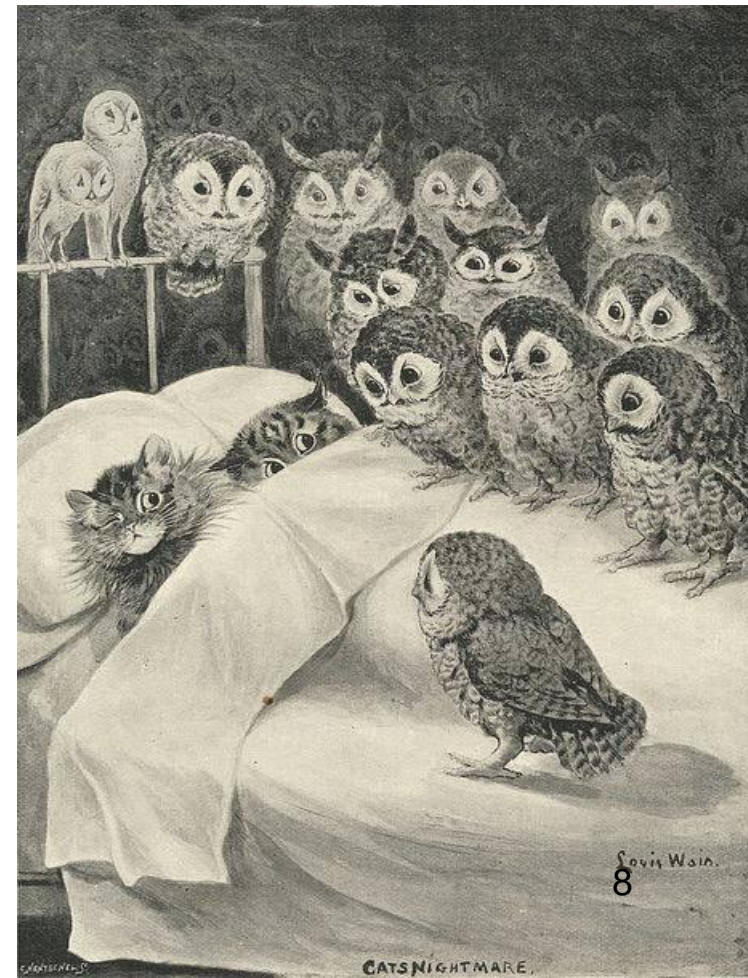
What are the boundary conditions?

Who is your audience?

- ✓ Experts (many juicy details)
- ✓ Non-experts (blue horizons)
- ✓ Both (a nightmare)

How much time?

- ✓ Single- or multidisciplinary conference?
- ✓ More similar talks?
- ✓ What time is your talk at?



What Is the Goal of Your Talk?

- ✓ Why are you giving the talk?
- ✓ What do you want from the talk?
- ✓ How do you motivate the audience?

Define

1-2-3 key points
...and stick to them

Consider

the audience expertise



2. Scientific Talk Outline

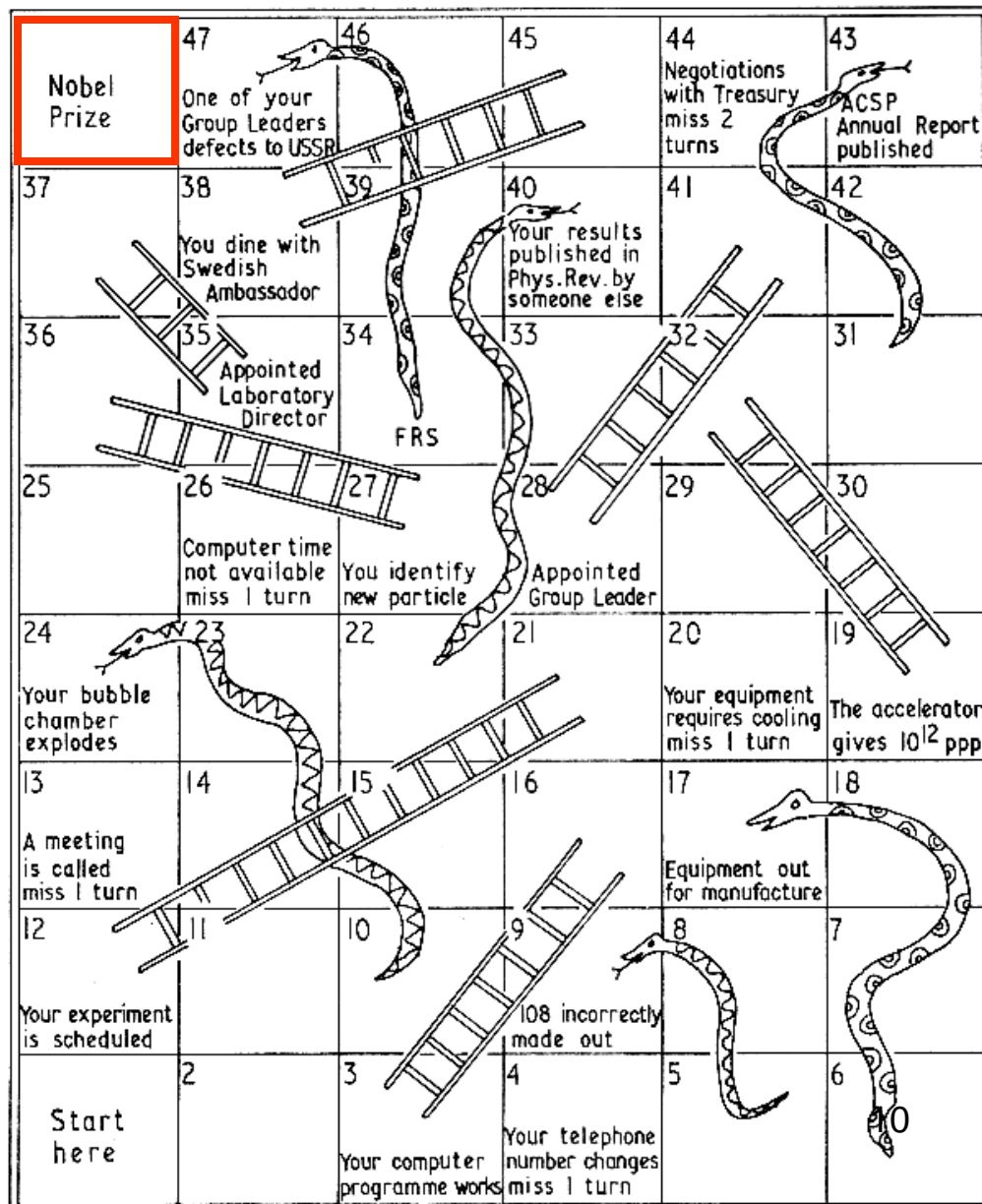
It is fixed as:

- ✓ outline
- ✓ introduction
- ✓ methods
- ✓ results
- ✓ conclusions and perspectives

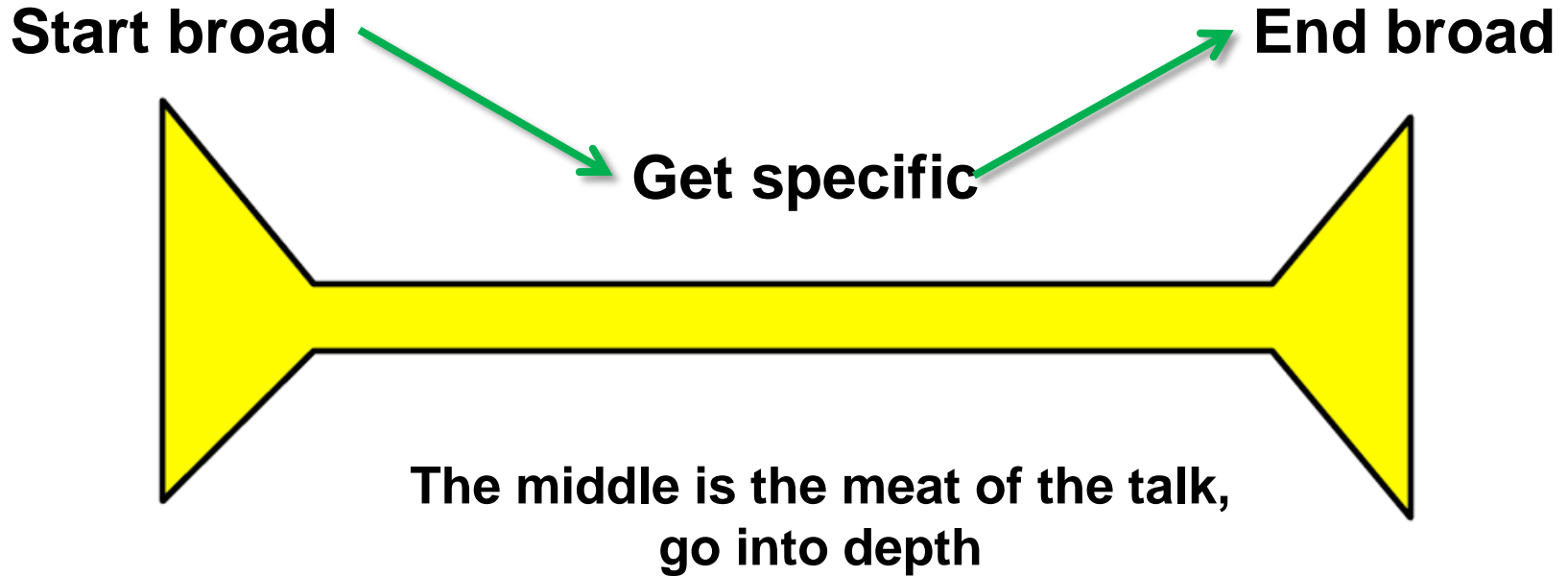
Building-up scheme

✓ introduction:
from general to particular

✓ conclusions:
from particular to general



Talk Structure



Start with the biggest questions and get progressively more specific

Focus on conclusions
End with the most specific conclusions, then build back out to the “big picture” and perspectives

Do You Need To Present Talk Outline?

- ✓ People like certainty
- ✓ Talk content in short
- ✓ What to expect
- ✓ How the talk is organized

Alternative strategy

(especially for a short talk)

summarize
the main results in
a single!
short!
statement during
the title slide



Introduction

Introduction is meant to prepare the audience for the subject

- ✓ **Structure: from general to particular**
- ✓ **Present an overview of the problem at large**
- ✓ **Give a short summary of the already-achieved**
- ✓ **Motivate your research**
- ✓ **Explicitly state the goals of your research**
- ✓ **Briefly mention the main results**

Introduction is the most important part

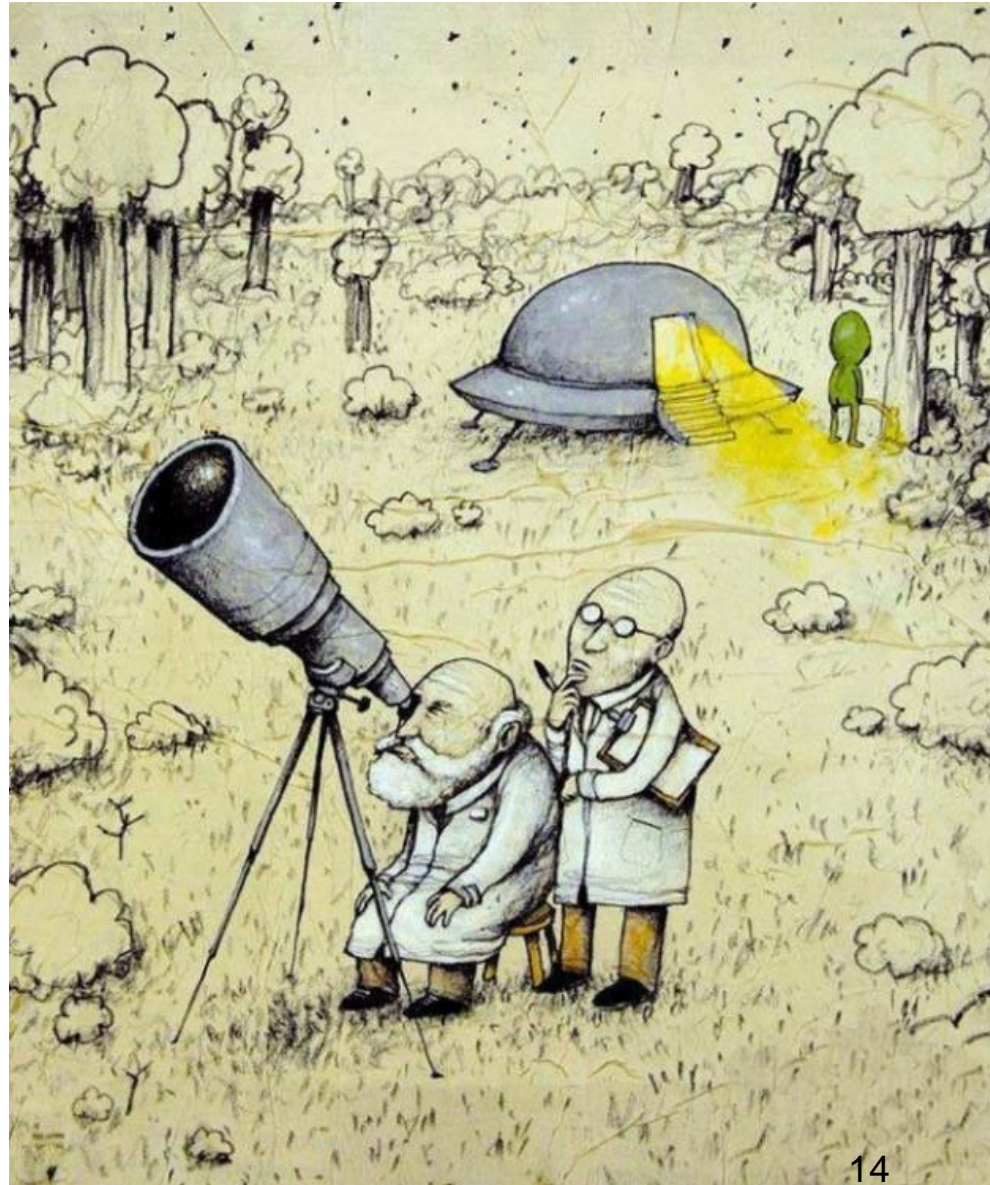
- ✓ **experts understand what to expect**
- ✓ **non-experts have already received 90% of information**



Strategies of Introduction

- ✓ Verification of details of a well-known problem
- ✓ New twist on the familiar
- ✓ Combination of both

Spend up to 30% of the talk
for the introduction
this will pay back hundredfold



«Dont's» Introduction

- ✗ Don't write much text
- ✗ Don't over-broaden the issue
- ✗ Don't undermine competitive studies
- ✗ Don't bend somebody's result to your favor
- ✗ Don't state more than 2 goals

Periodic Table of Elements

1869, by Dmitri Mendeleev
(RUSSIAN BIGAMIST)

SOME SCIENTISTS THINK HELIUM SHOULD GO HERE.

SOME SCIENTISTS THINK HYDROGEN SHOULD GO HERE.

1902: THEY ADDED A WHOLE COLUMN.

1914: THEY REORGANIZED THE TABLE BY ATOMIC NUMBER INSTEAD OF ATOMIC WEIGHT.

1940: THEY ADDED TWO ROWS.

26 ELEMENTS HAVE BEEN ADDED SINCE 1923, WHEN WILL IT END?

1	2											3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
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WARNING:
Chemical Periodicity is a theory. The theory keeps changing.
The theory is under dispute.
Teach alternative theories to children! (SEE BELOW)

over 49th in th

Methods

- ✓ can be omitted in a short talk
(unless they're the essence of the talk)
- ✓ first explain methods qualitatively
- ✓ and only then present a quantitative description (only if it's absolutely necessary)

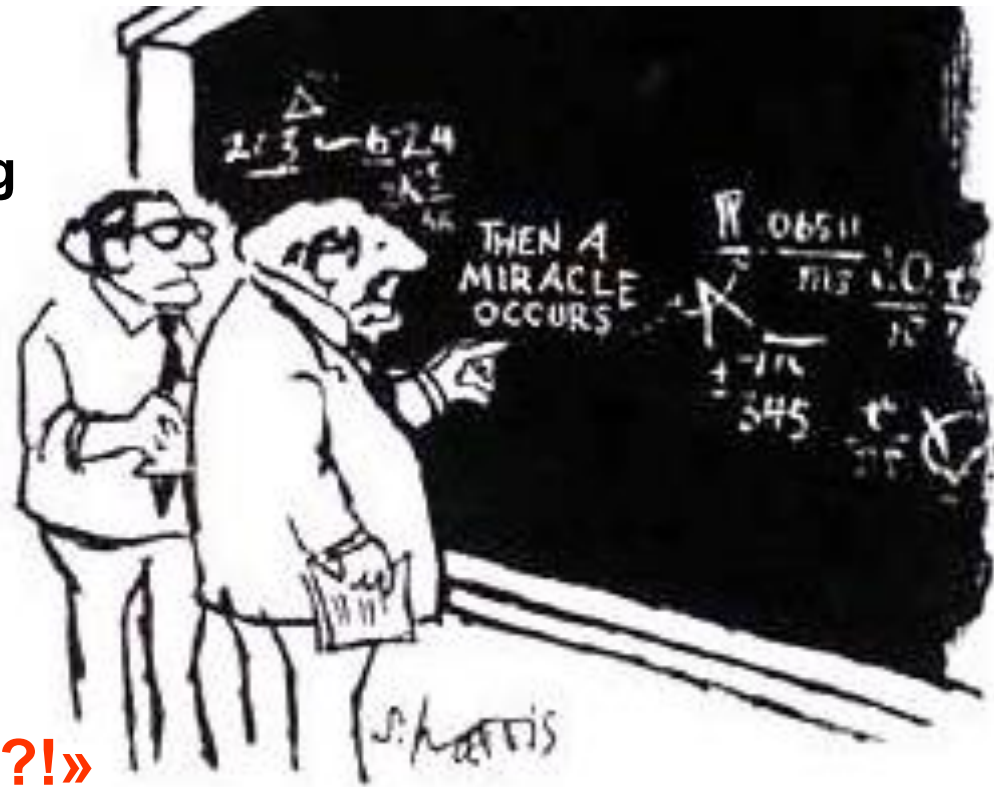


«I'm on the verge of a major breakthrough, but I'm also at the point where chemistry leaves off and physics begins, so I'll have to drop the whole thing»

Results

Results are the main and original part of your presentation

- ✓ Organization: from simple to complex
- ✓ Present main results only
- ✓ Take care of logics
- ✓ Demonstrate clear understanding
- ✓ Explain main consequences
- ✓ Having reached the climax, make your way downhill



Answer the question

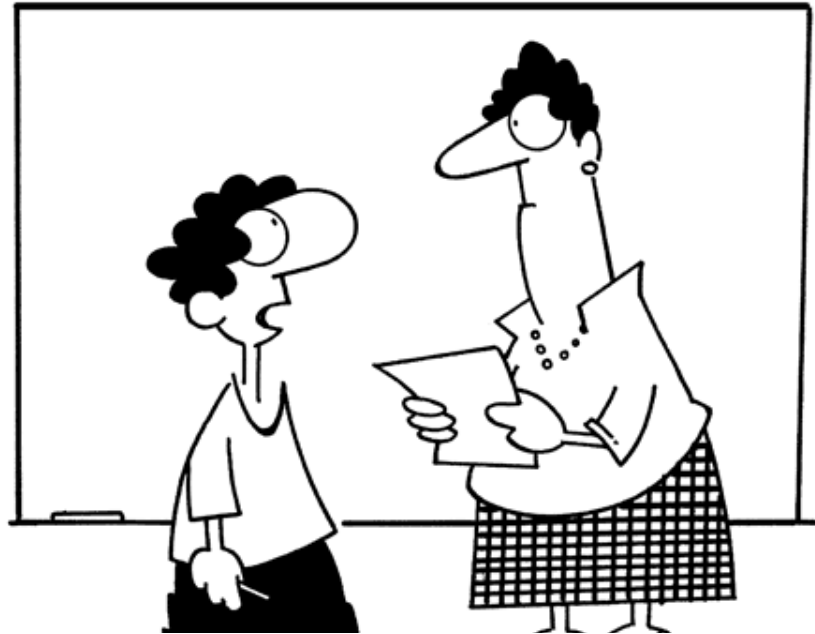
«What have I done really new?!»

(for yourself)

«You should be more explicit here»

«Dont's» Results

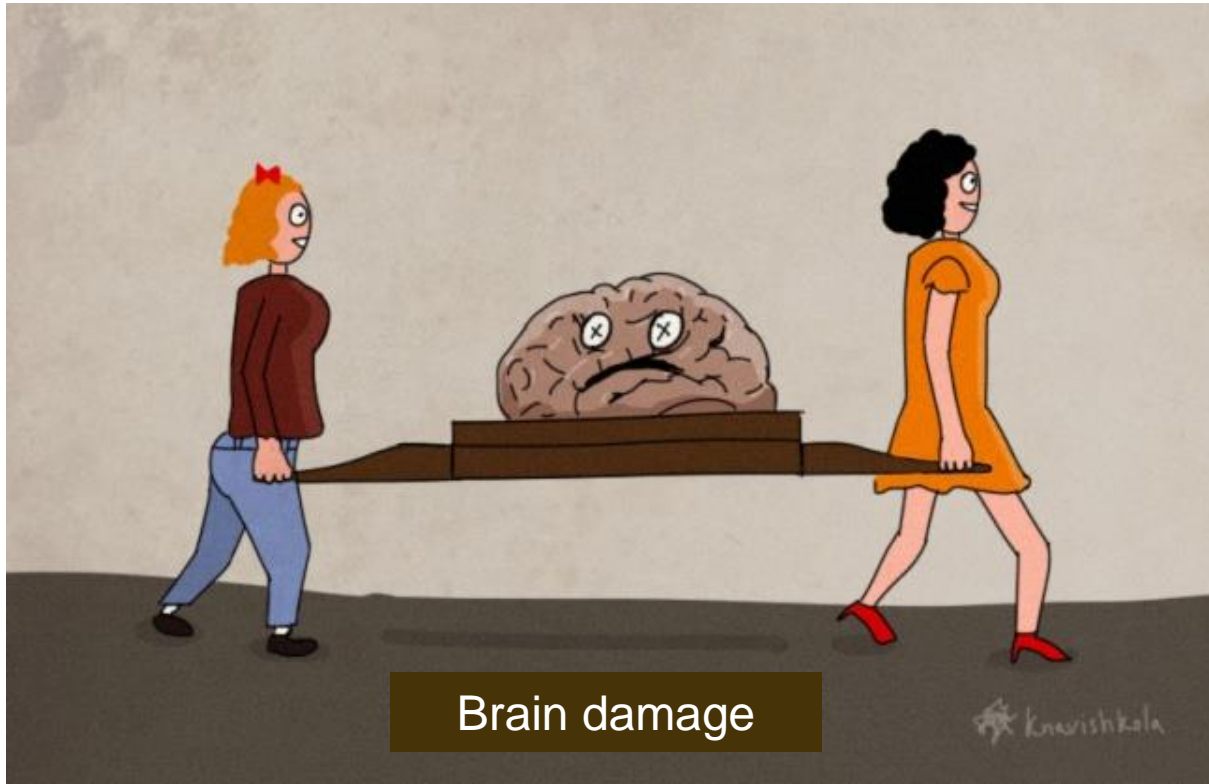
- ✗ Don't try to report ALL your results
- ✗ Don't give numbers without explaining their significance
- ✗ Don't present extensive tables with a lot of numbers
- ✗ Don't write equations without explaining each variable
- ✗ Don't try to impress audience by complicated equations
- ✗ Don't jump from one subject to another



«I turned in my homework two days late, but normally it's four days late,¹⁸ so technically it's early!»

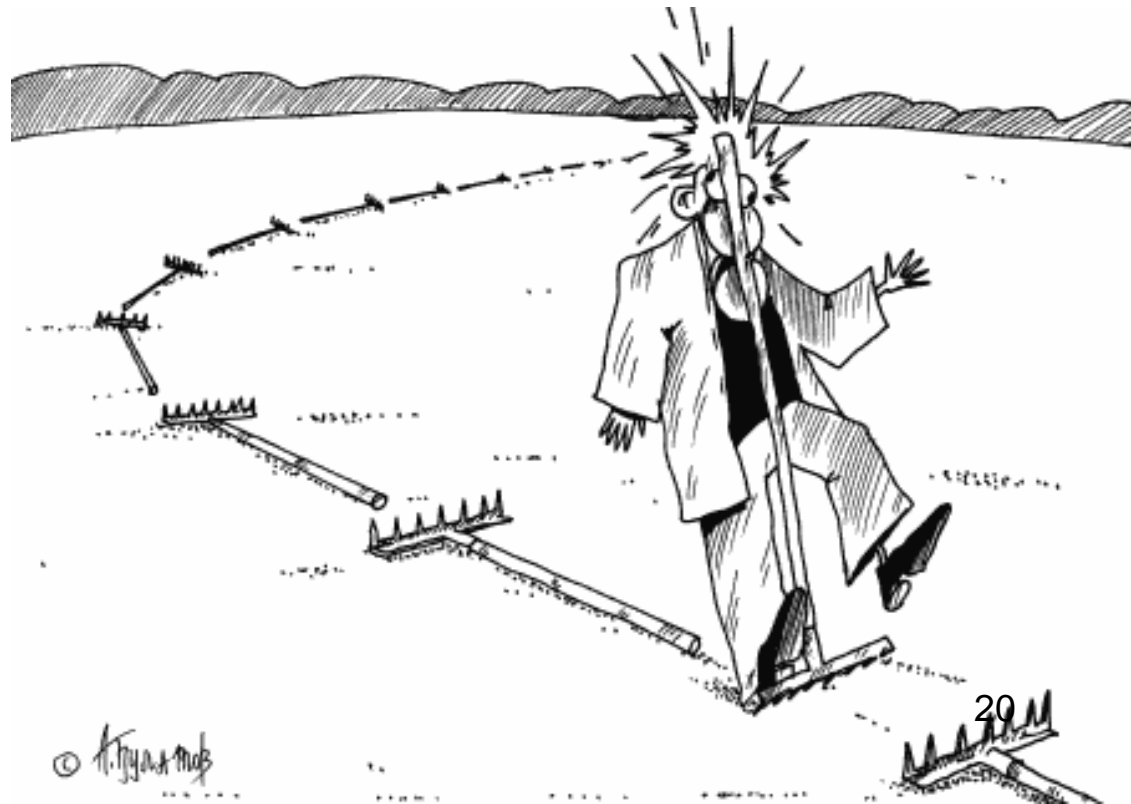
Conclusions

- ✓ From particular to general
- ✓ Summarize your results
- ✓ Tell what you have achieved
- ✓ Place your results in a broader picture
- ✓ Outline the prospects



«Don't's» Conclusions

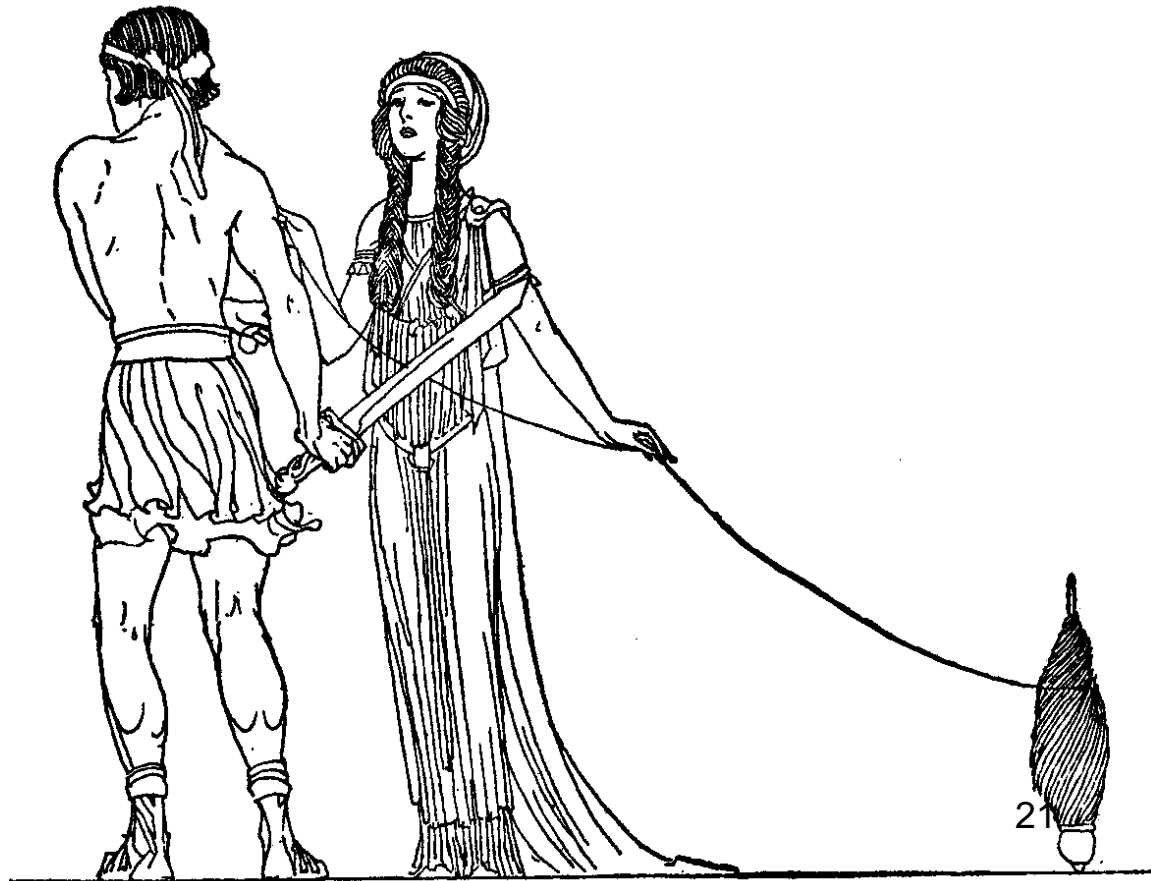
- ✗ Don't write 3 slides with a small script
- ✗ Don't sink yourself
(others will do it ... with great pleasure)
- ✗ Don't be shy, but...
- ✗ Don't oversell your results
- ✗ Don't forget acknowledgments



3. Preparing the Slides

Slides are your Ariadne's threat

Use visual aids wherever possible!



Number of Slides and Talk's Timing

Going Overtime is a *Very Bad Idea*

- ✓ impolite and selfish
- ✓ demonstrate lack of practicing
- ✓ deprives you the discussion
- ✓ may cost a part of your talk

Pitfall:

*I'll never fill 15 minutes!
I'll make 100 slides!!!*

My rule of thumb:

1 slide = 1 minute
(make your own calibration!)



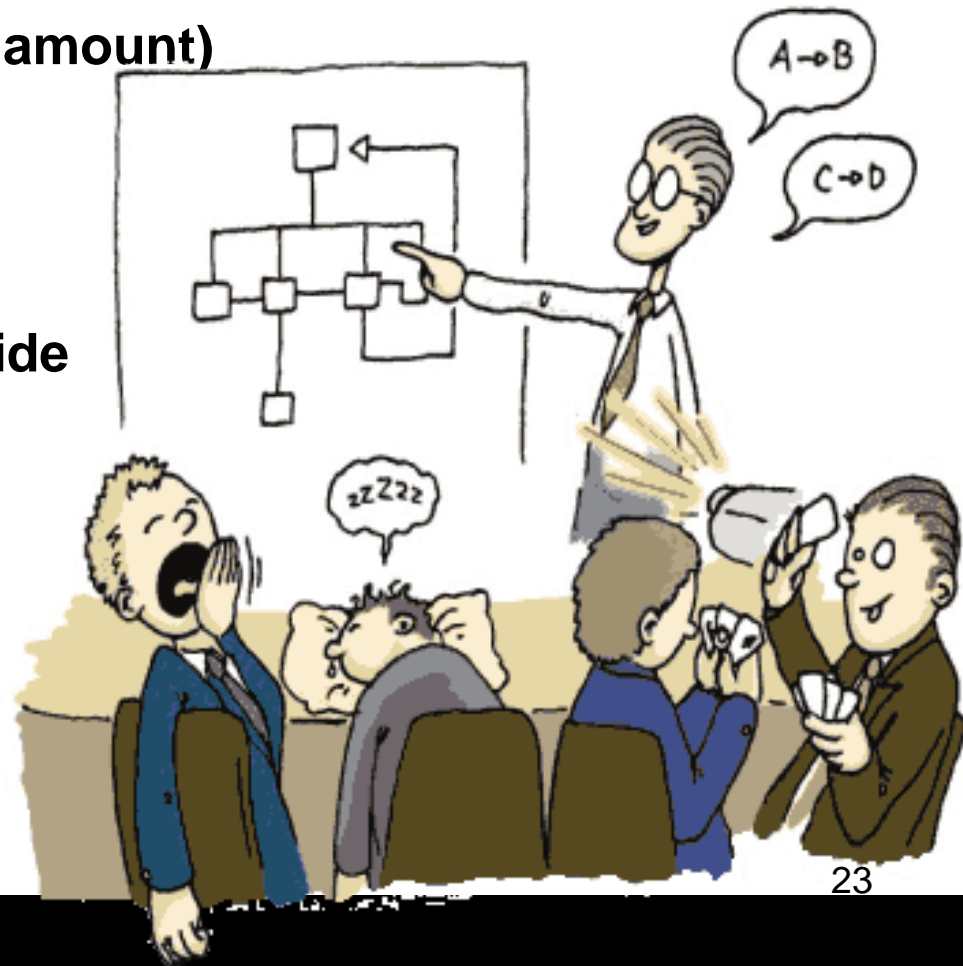
It's better to end up slightly earlier than much later! 22

Example: How Many Slides?

Talk duration: 15 minutes (+5 min for discussion)

no more than 15 slides

- ✓ Title – 1 slide
- ✓ Intro – 4-5 slides (~1/3 of the total amount)
- ✓ Goals – 1 slide
- ✓ Methods – 1(0) slide
- ✓ Results – 6-7 slides
- ✓ Conclusions and prospects – 1 slide
- ✓ Acknowledgments – 1 slide



Slide Design

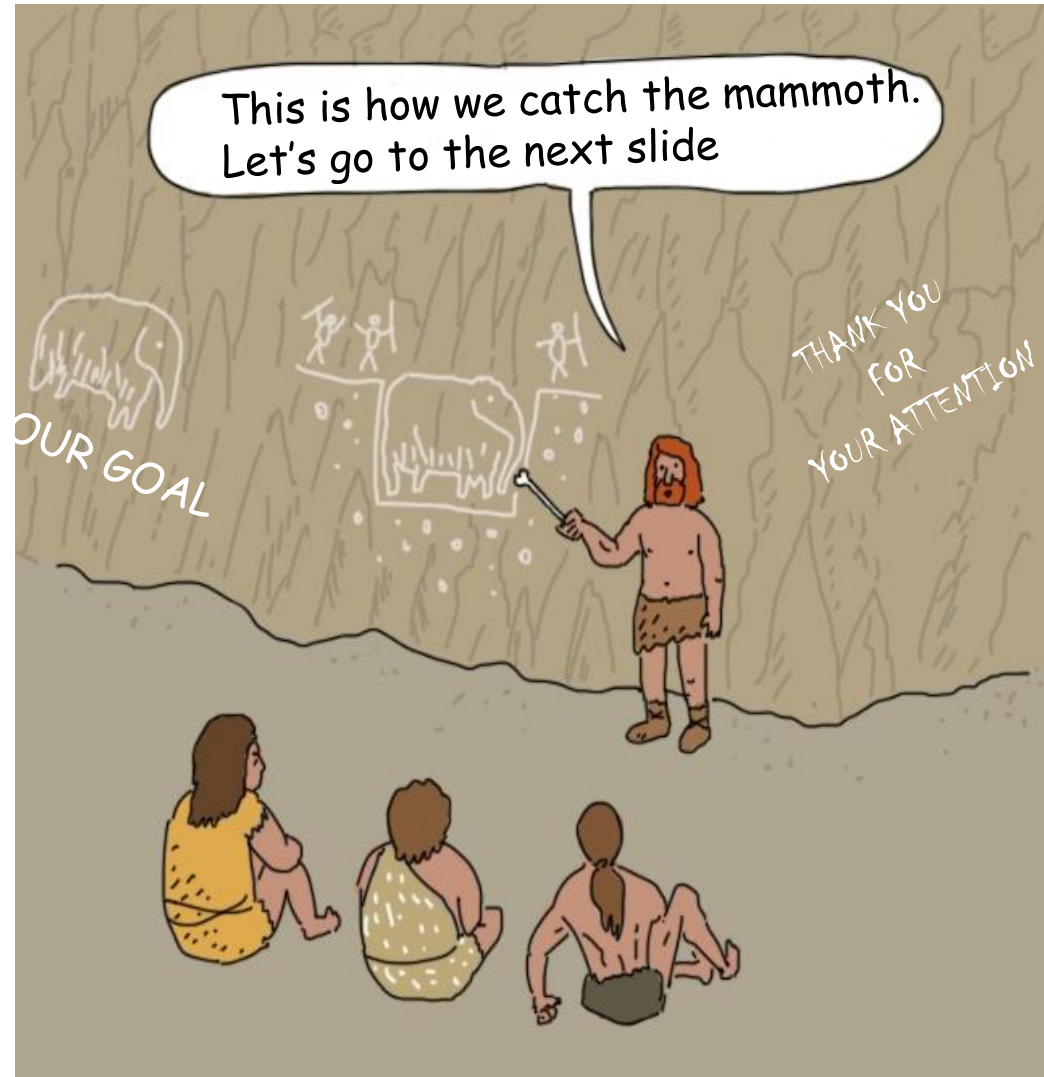
Think of your talk as a series of episodes

Each episode (slide) has:

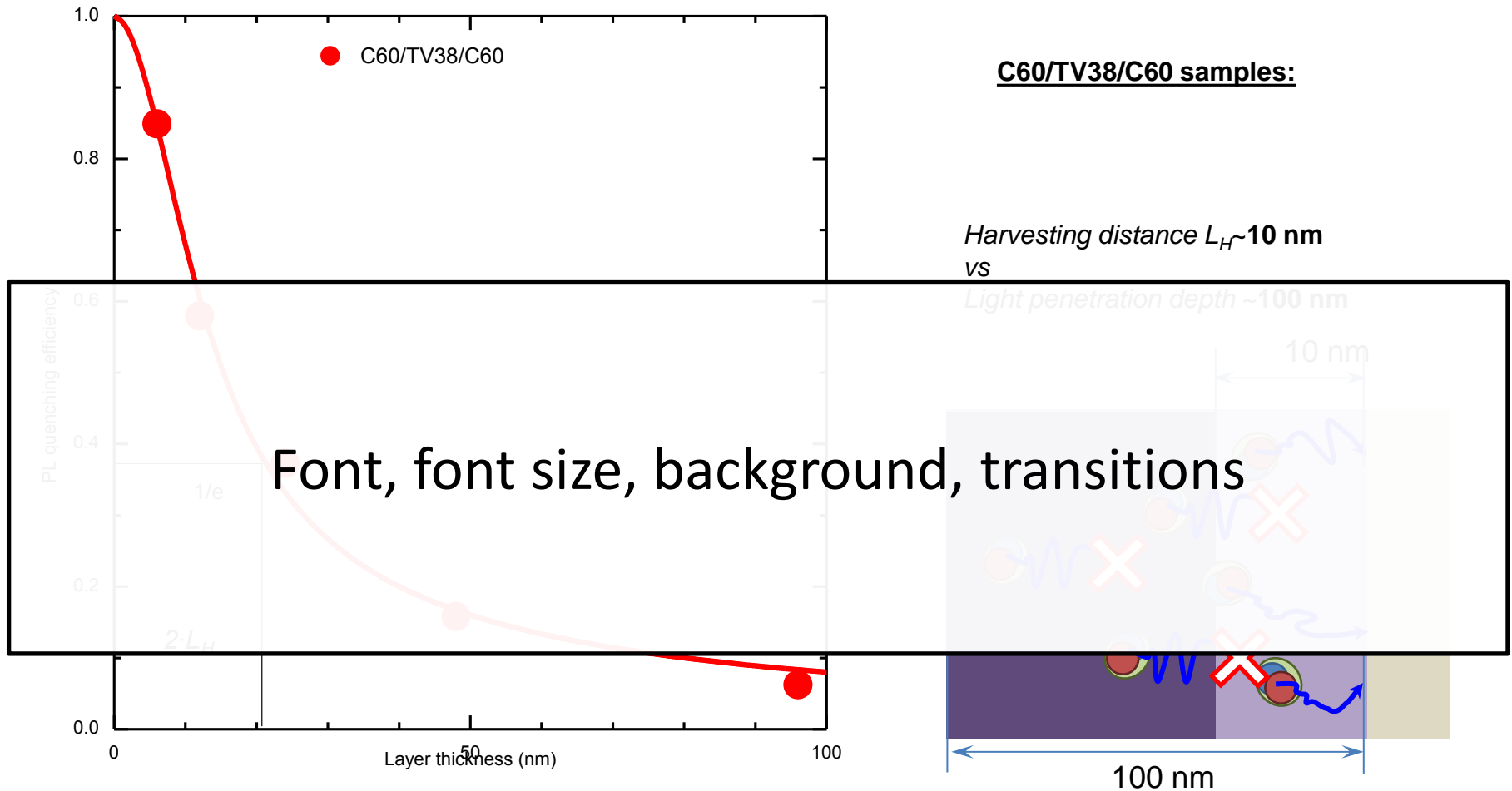
- connection to the previous episode
- goal
- content
- conclusion (one per slide)
- which links this slide to the next one

Useful rules:

- Include images on every slide
- Don't draw the audience with data
- If you are not going to take time to explain it, get rid of it!

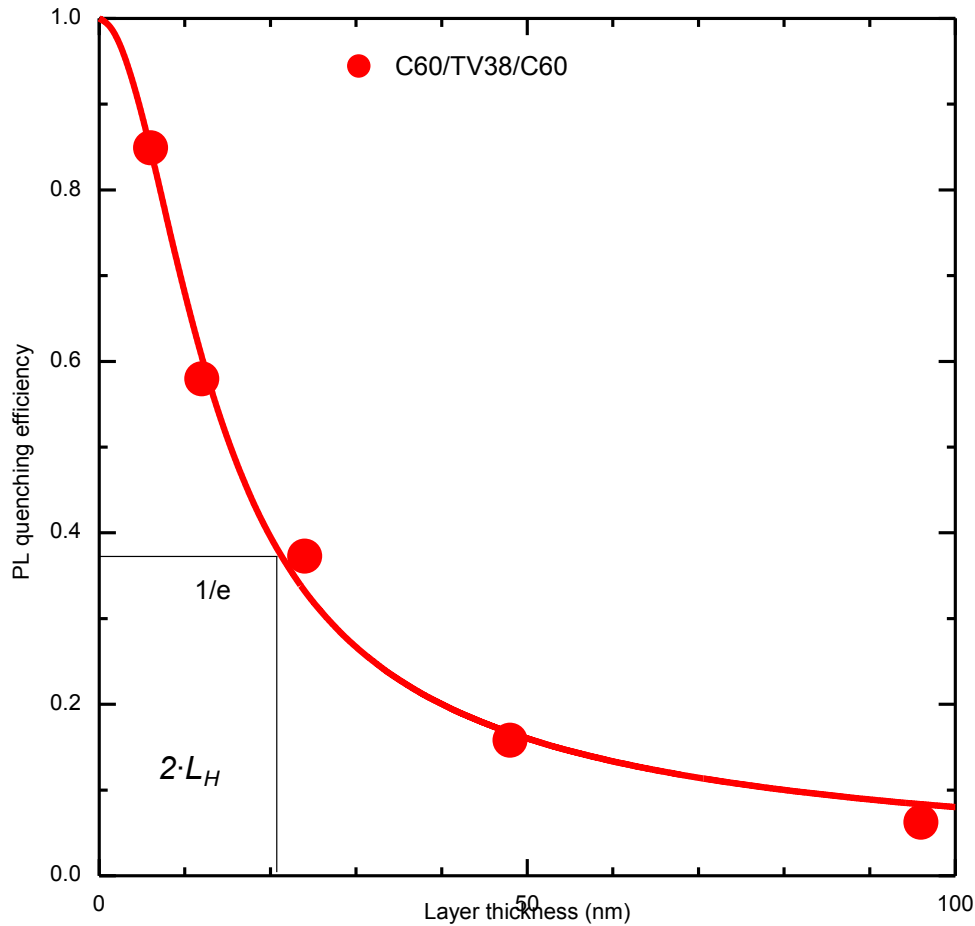


Exciton Harvesting Distance



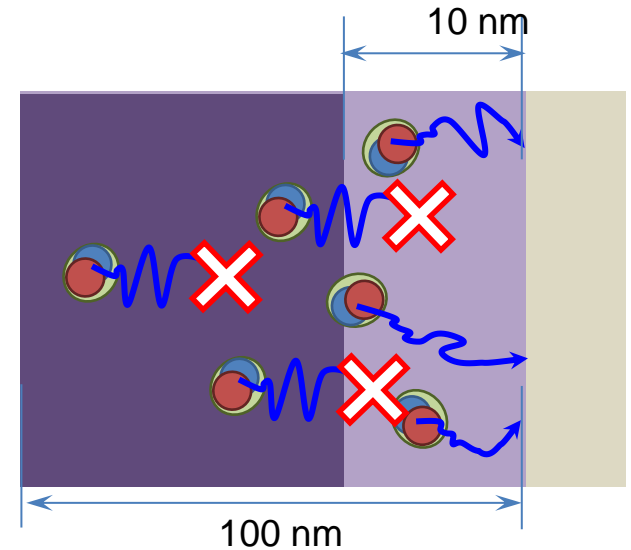
No point in making thick absorbing layers
Typical for disordered solution-processed organics

Exciton Harvesting Distance



C60/TV38/C60 samples:

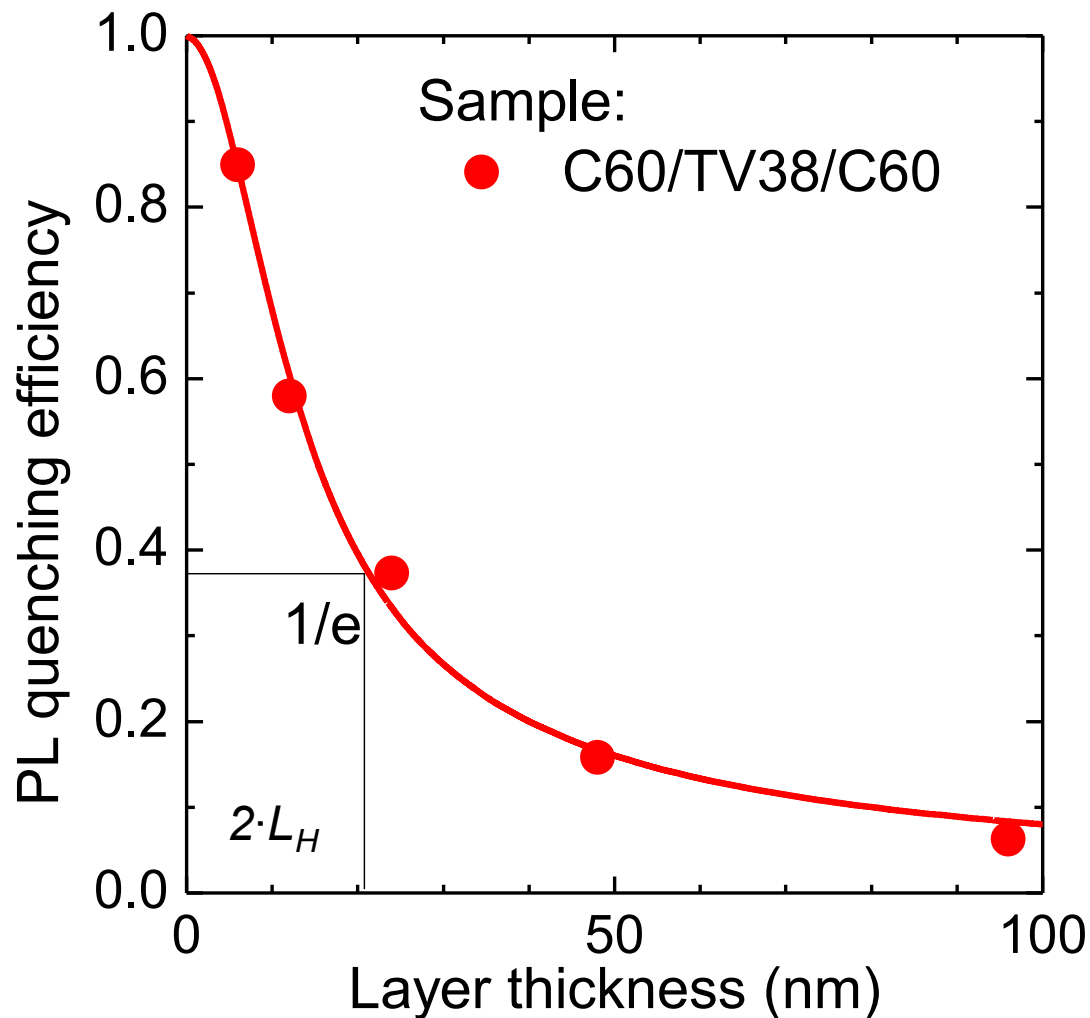
Harvesting distance $L_H \sim 10$ nm
vs
Light penetration depth ~ 100 nm



No point in making thick absorbing layers
Typical for disordered solution-processed organics

Font choice

Exciton Harvesting Distance

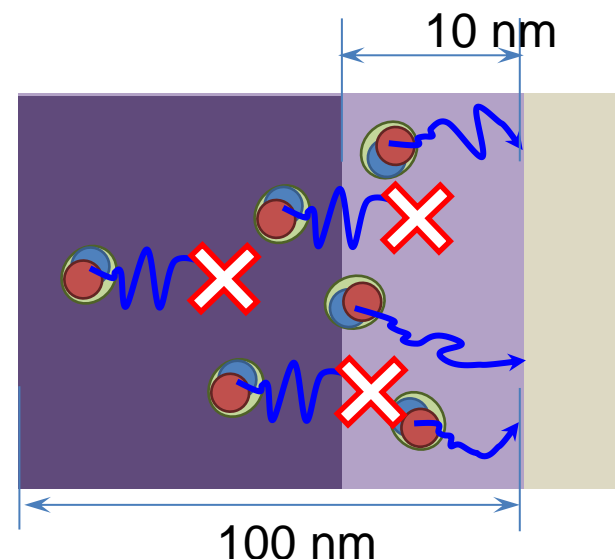


C60/TV38/C60 samples:

Harvesting distance $L_H \sim 10$ nm

vs

Light penetration depth ~ 100 nm

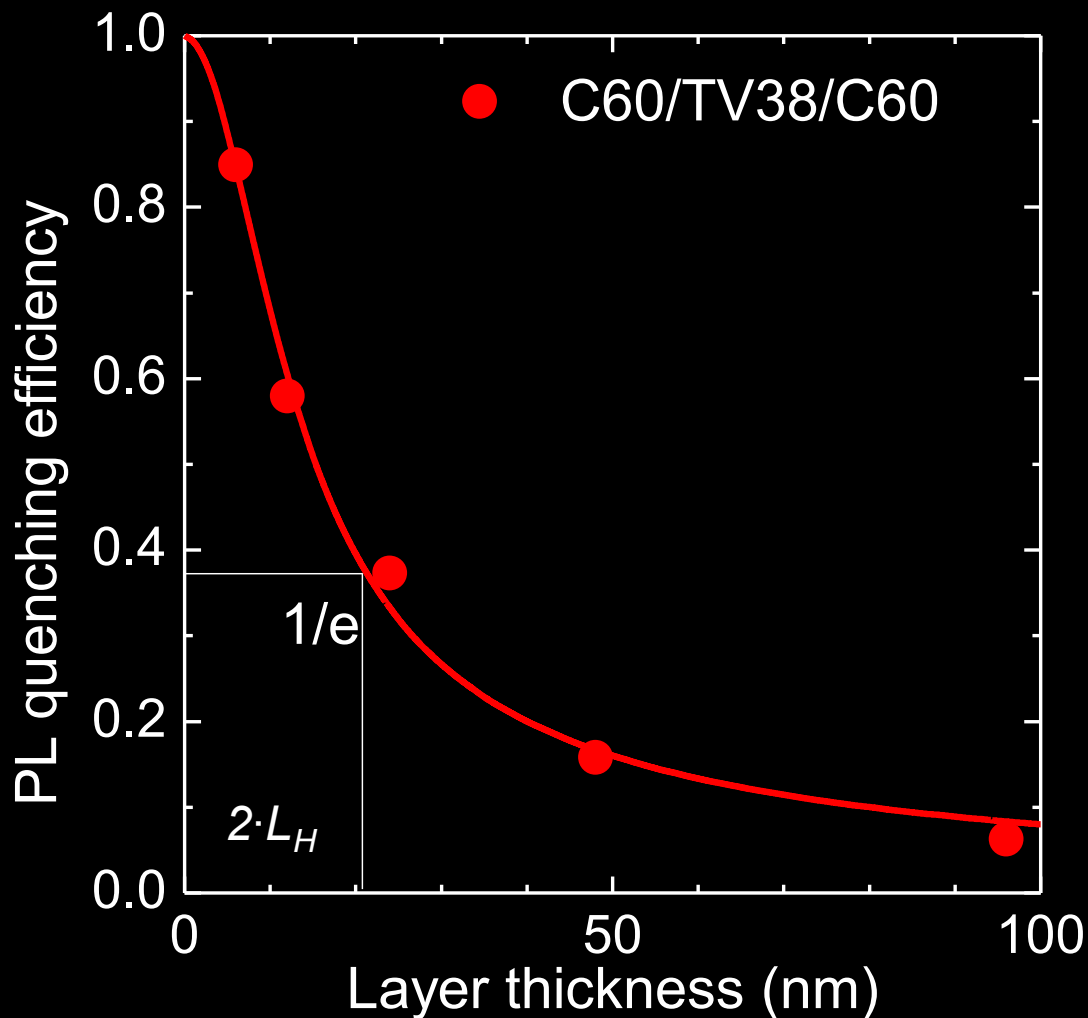


No point in making thick absorbing layers

Typical for disordered solution

Background choice

Exciton Harvesting Distance

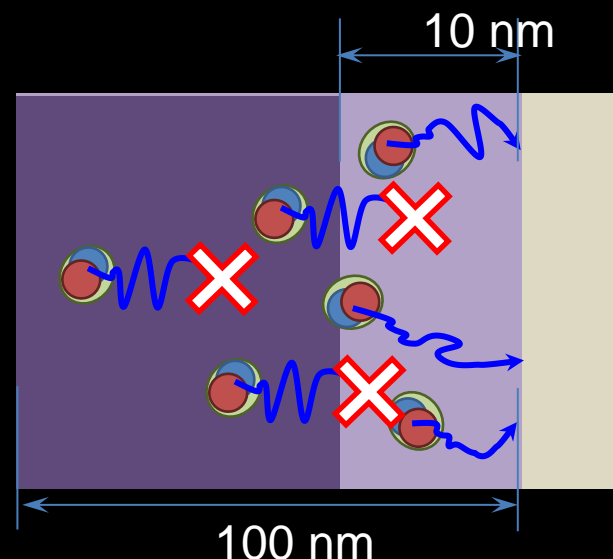


C60/TV38/C60 samples:

Harvesting distance $L_H \sim 10$ nm

vs

Light penetration depth ~ 100 nm

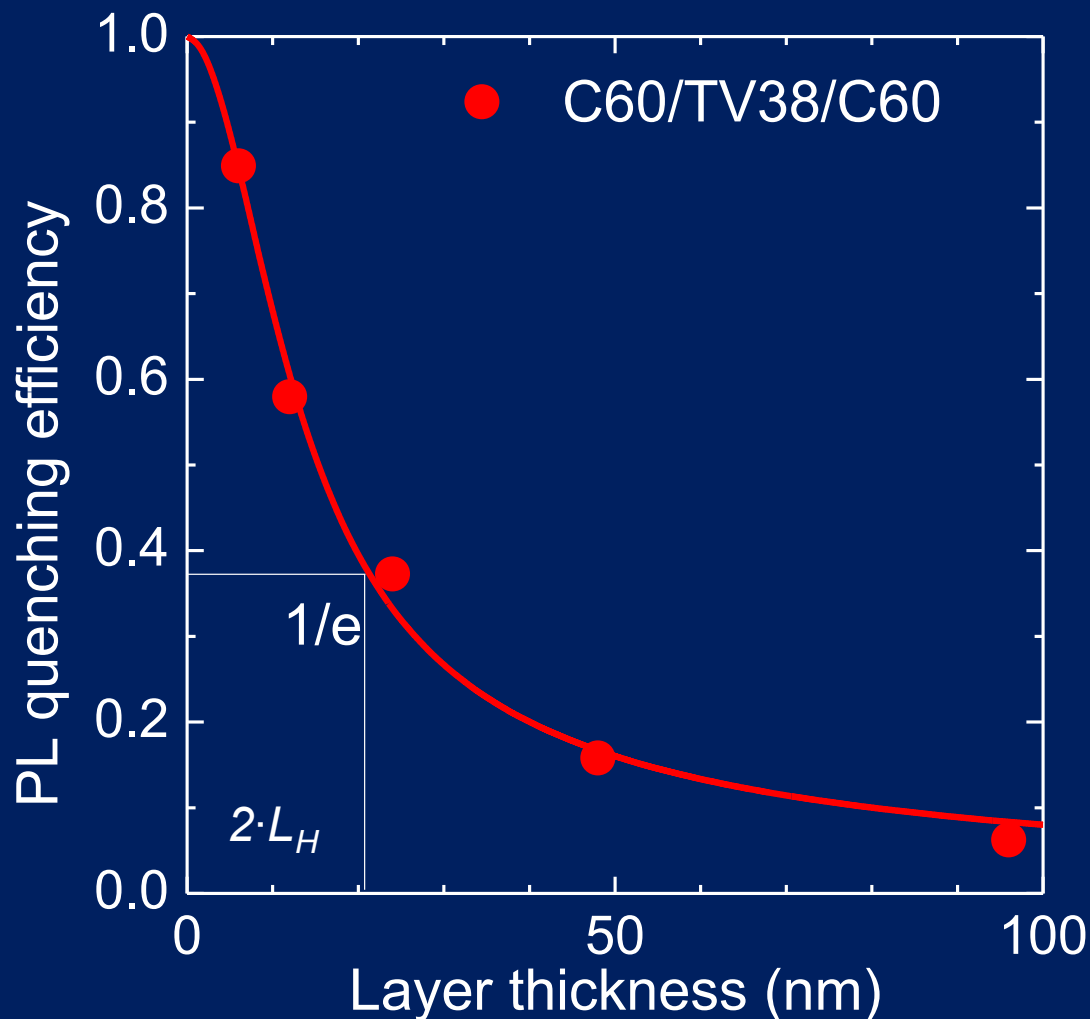


No point in making thick absorbing layers

Typical for disordered solution-

Background choice

Exciton Harvesting Distance

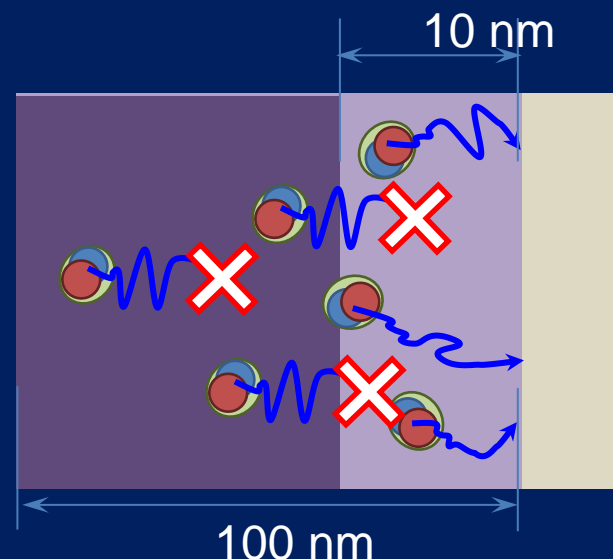


C60/TV38/C60 samples:

Harvesting distance $L_H \sim 10$ nm

vs

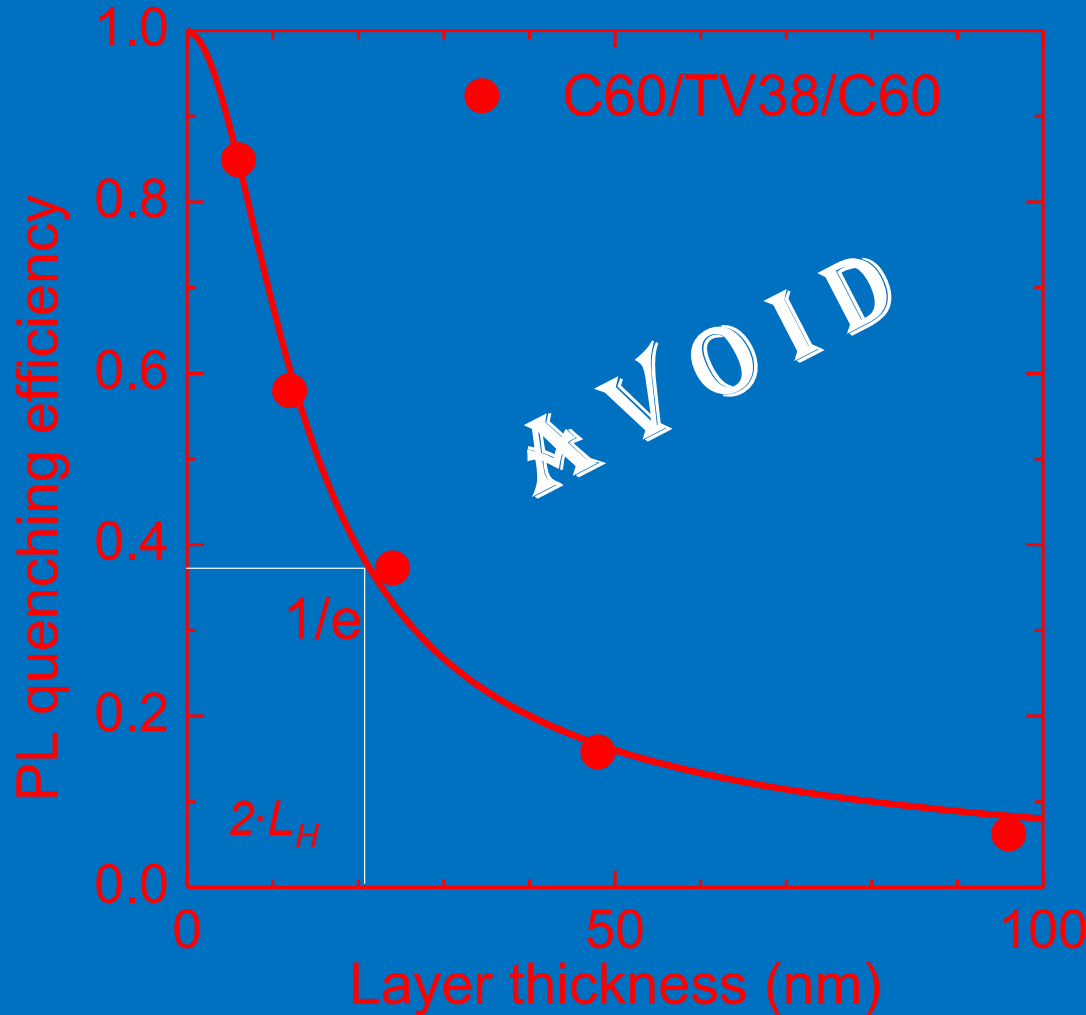
Light penetration depth ~ 100 nm



No point in making thick absorbing layers

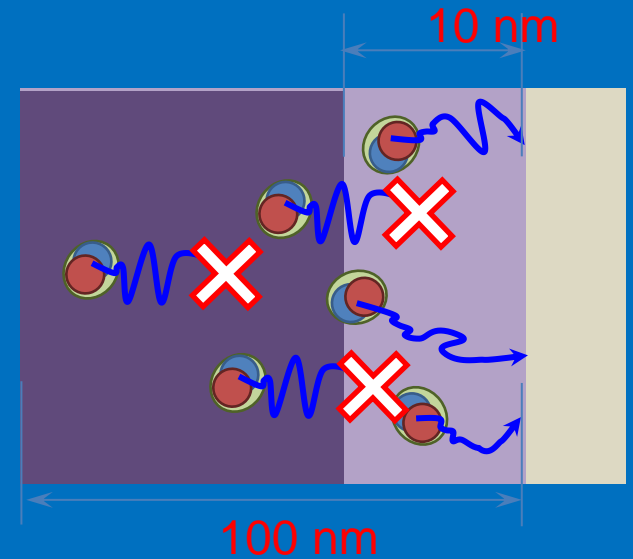
Typical for disordered solution-processed background choice

Exciton Harvesting Distance



C60/TV38/C60 samples:

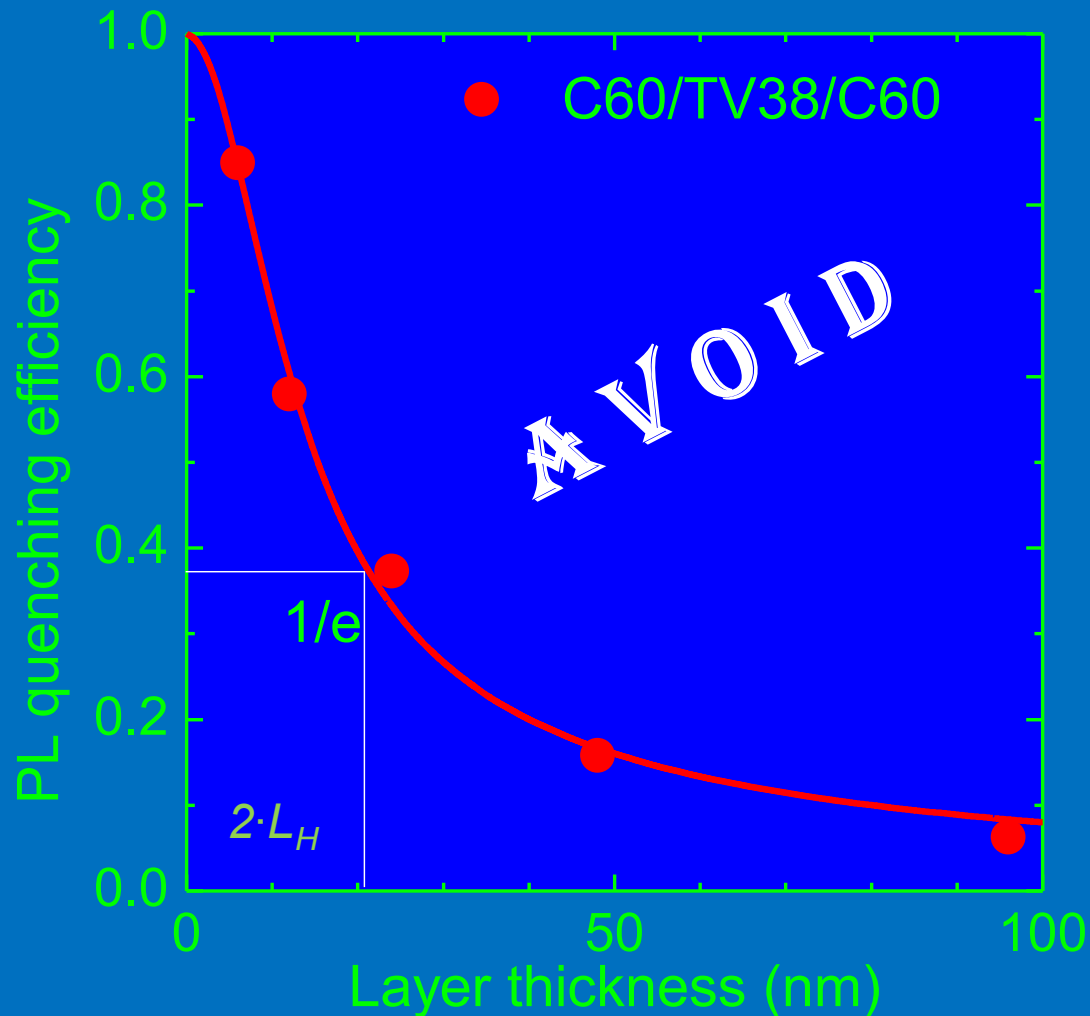
Harvesting distance $L_H \sim 10$ nm
vs
Light penetration depth ~ 100 nm



No point in making thick absorbing layers
Typical for disordered solution

Background choice

Exciton Harvesting Distance

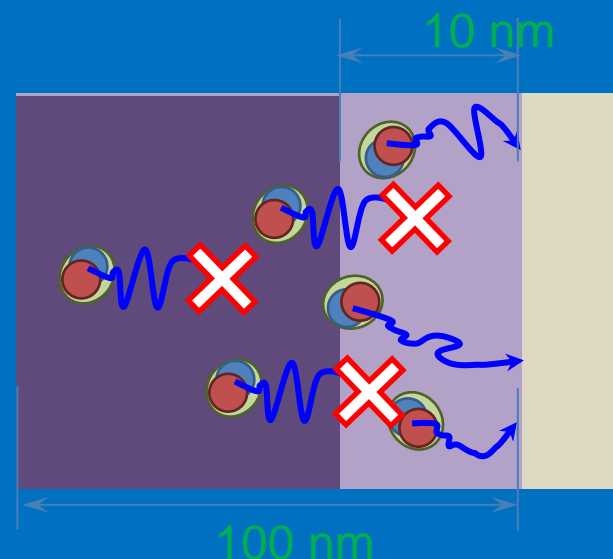


C60/TV38/C60 samples:

Harvesting distance $L_H \sim 10$ nm

vs

Light penetration depth ~ 100 nm

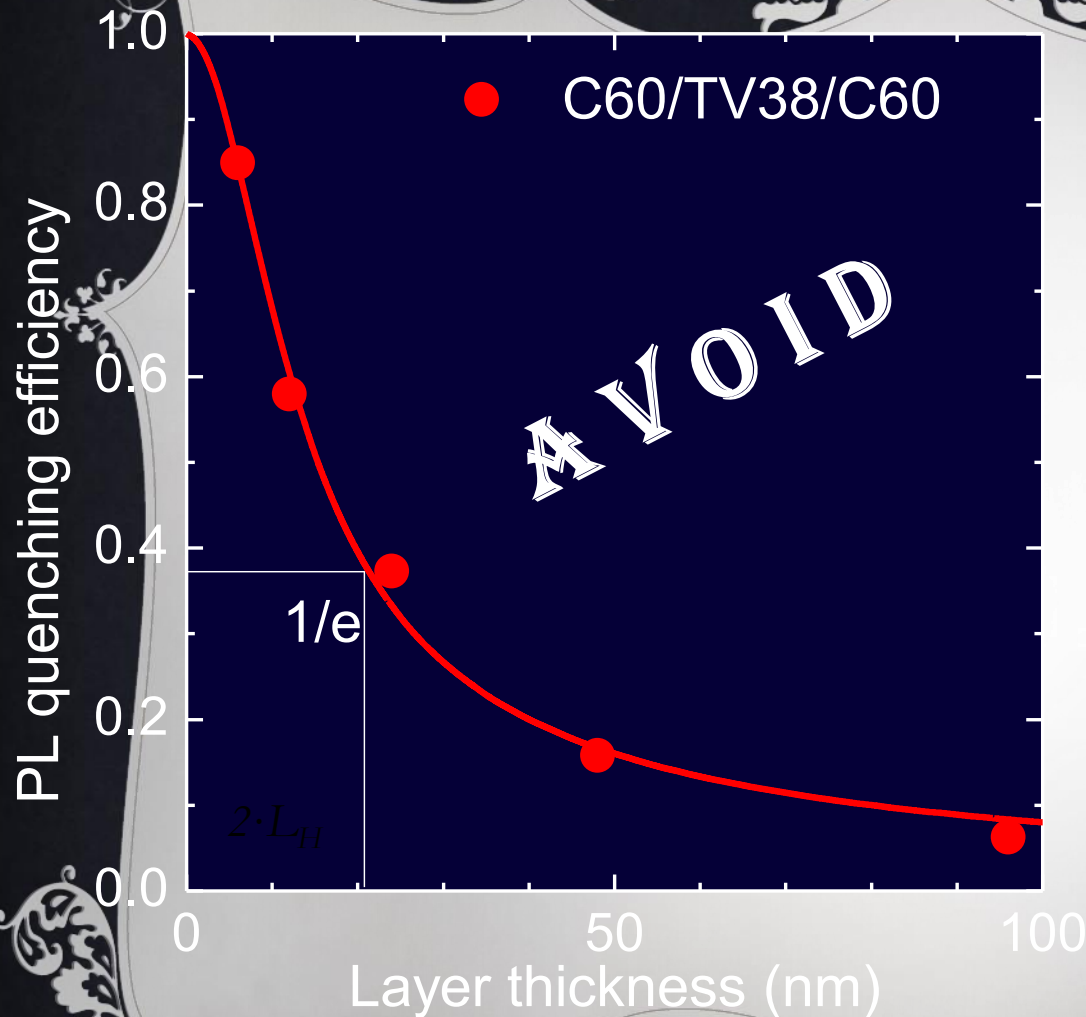


No point in making thick absorbing layers

Typical for disordered solution-

Background choice

Avoid Fancy Background !!!

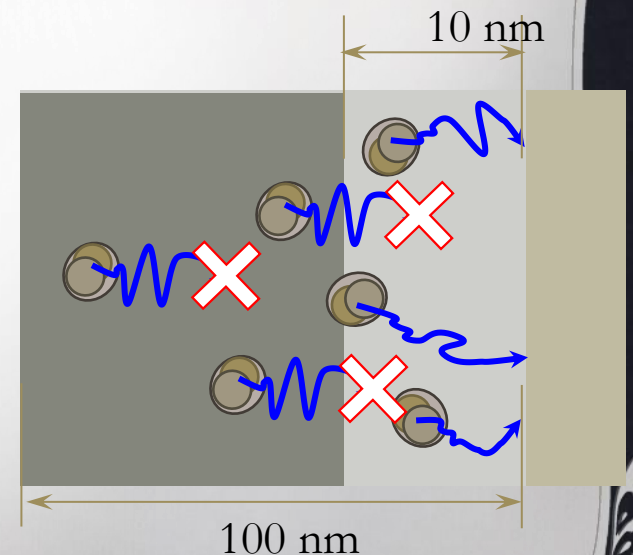


C60/TV38/C60 samples:

Harvesting distance $L_H \sim 10$ nm

vs

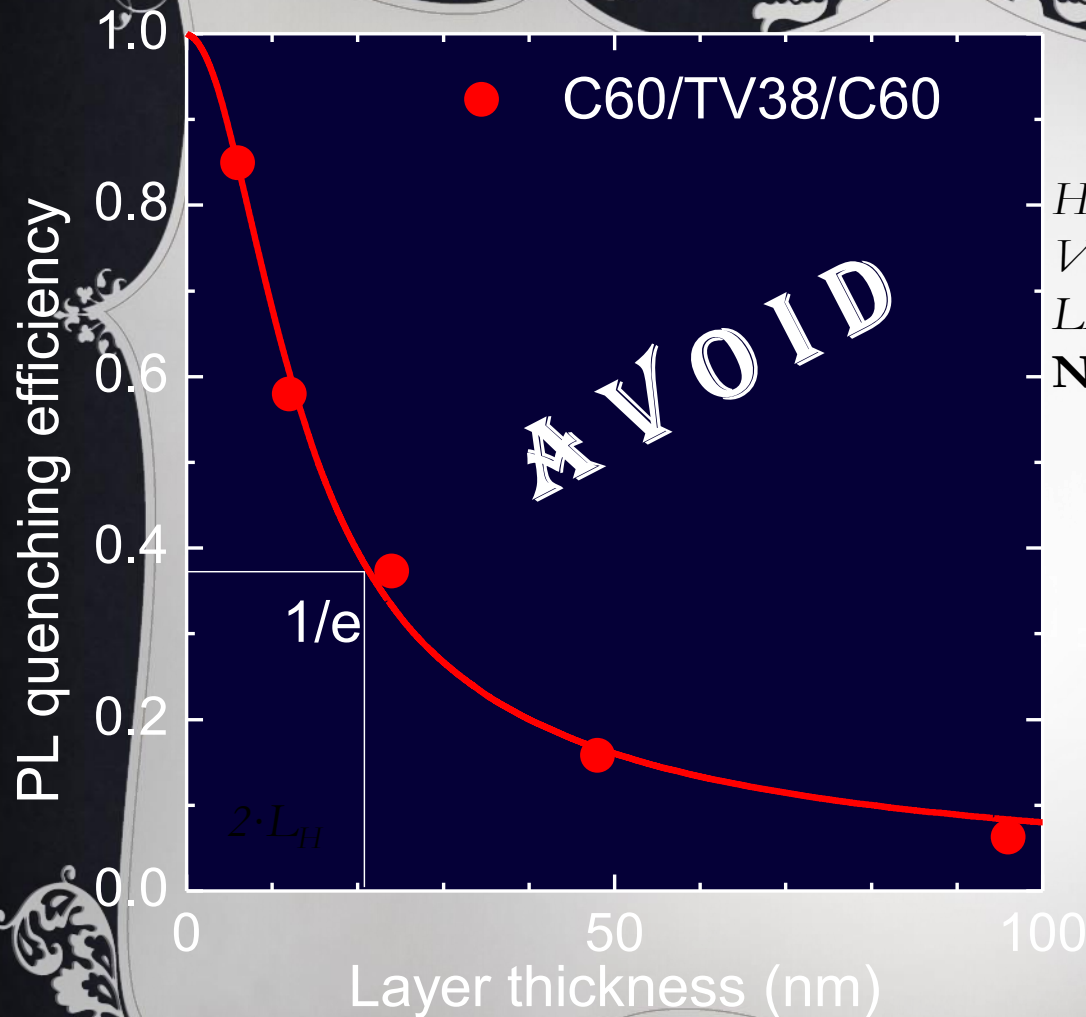
Light penetration depth ~ 100 nm



No point in making thick absorbing layers
Typical for disordered solution-processed organics

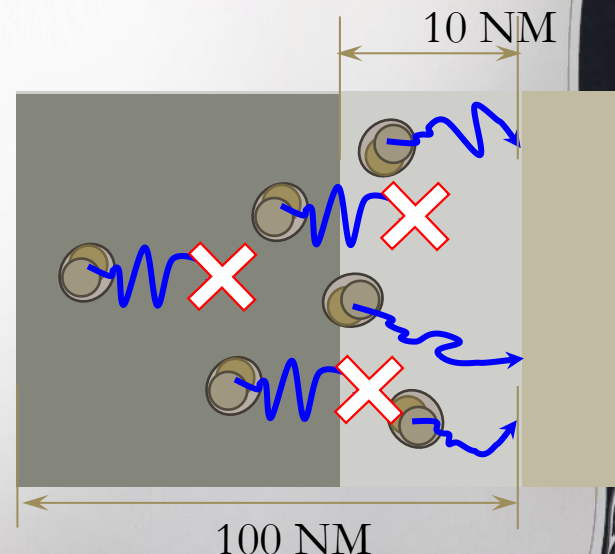
Background choice

AVOID UNNECESSARY CAPITALIZATION !!!



C60/TV38/C60 SAMPLES:

HARVESTING DISTANCE $L_H \sim 10$ NM
VS
LIGHT PENETRATION DEPTH ~ 100 NM

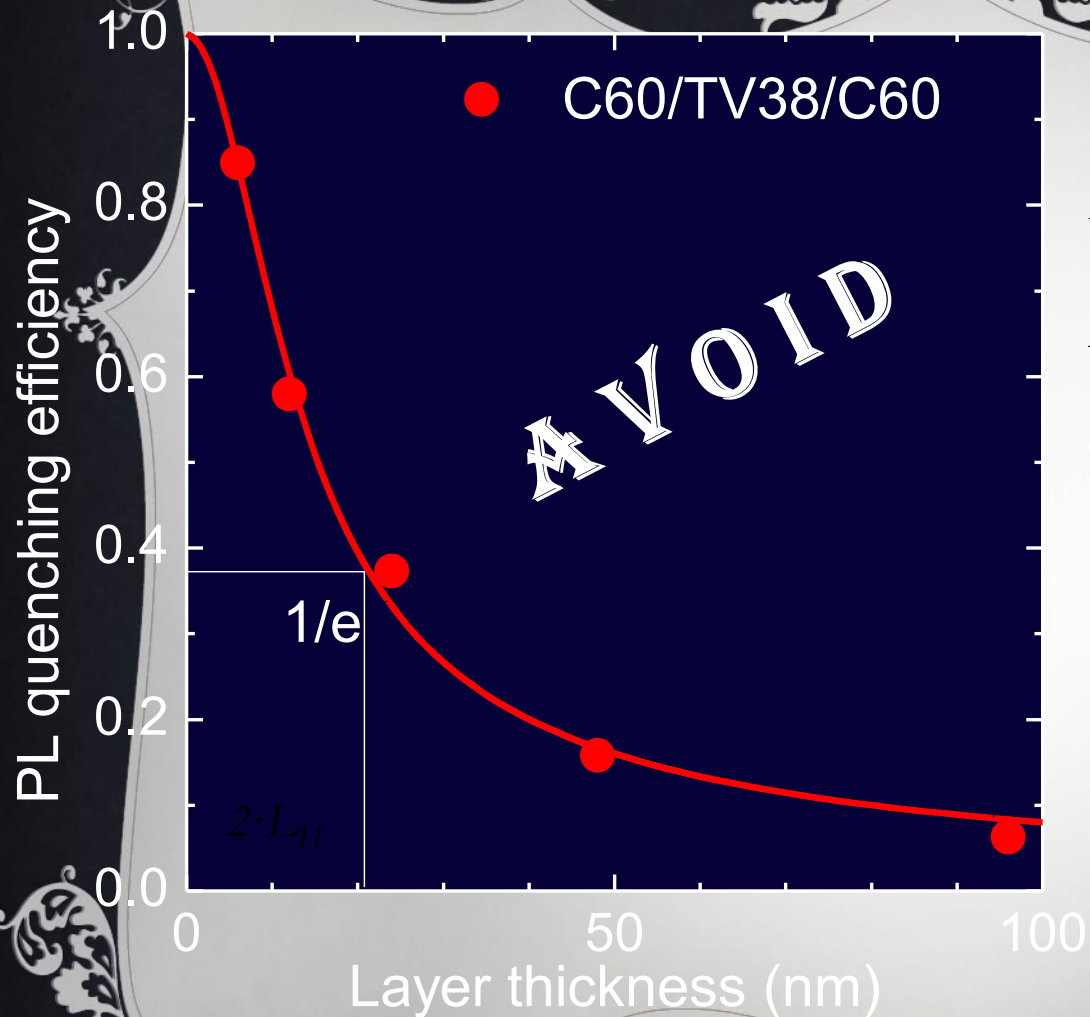


NO POINT IN MAKING THICK ABSORBING LAYERS

TYPICAL FOR DISORDERED SOLUTION

Background choice

AVOID FANCY TRANSITIONS !!!

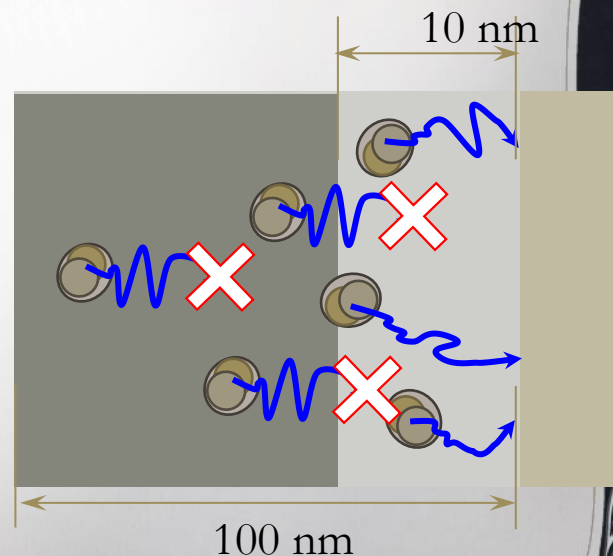


C60/TV38/C60 samples:

Harvesting distance $L_H \sim 10$ nm

vs

Light penetration depth ~ 100 nm



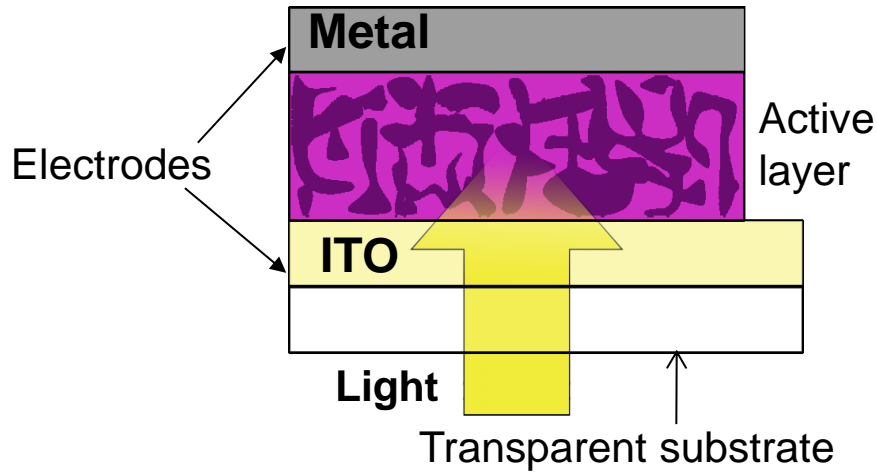
No point in making thick absorbing layers
Typical for disordered solution-

Background choice



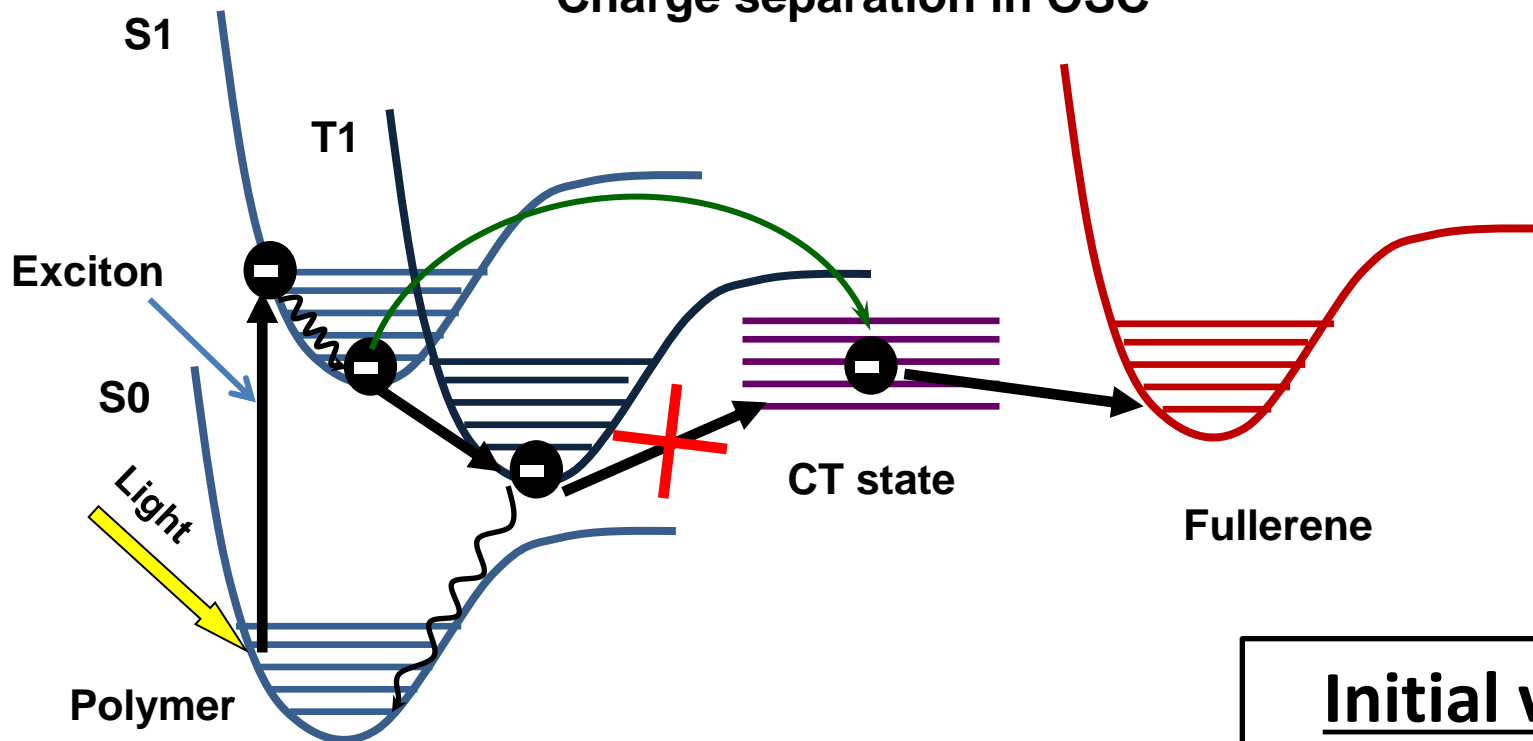
EXAMPLES
and
Rules of Slide-Making

Photophysics of Organic Solar Cells



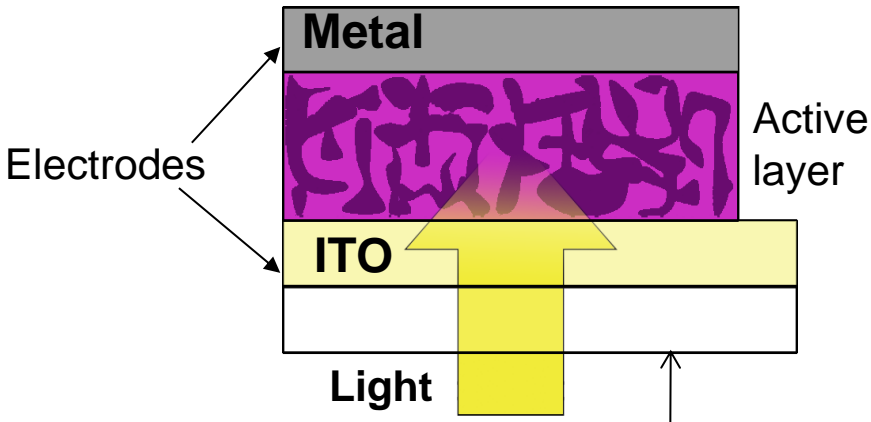
- Ease of manufacturing
- Semitransparency
- Flexibility

Charge separation in OSC



Initial version

Photophysics of Organic Solar Cells

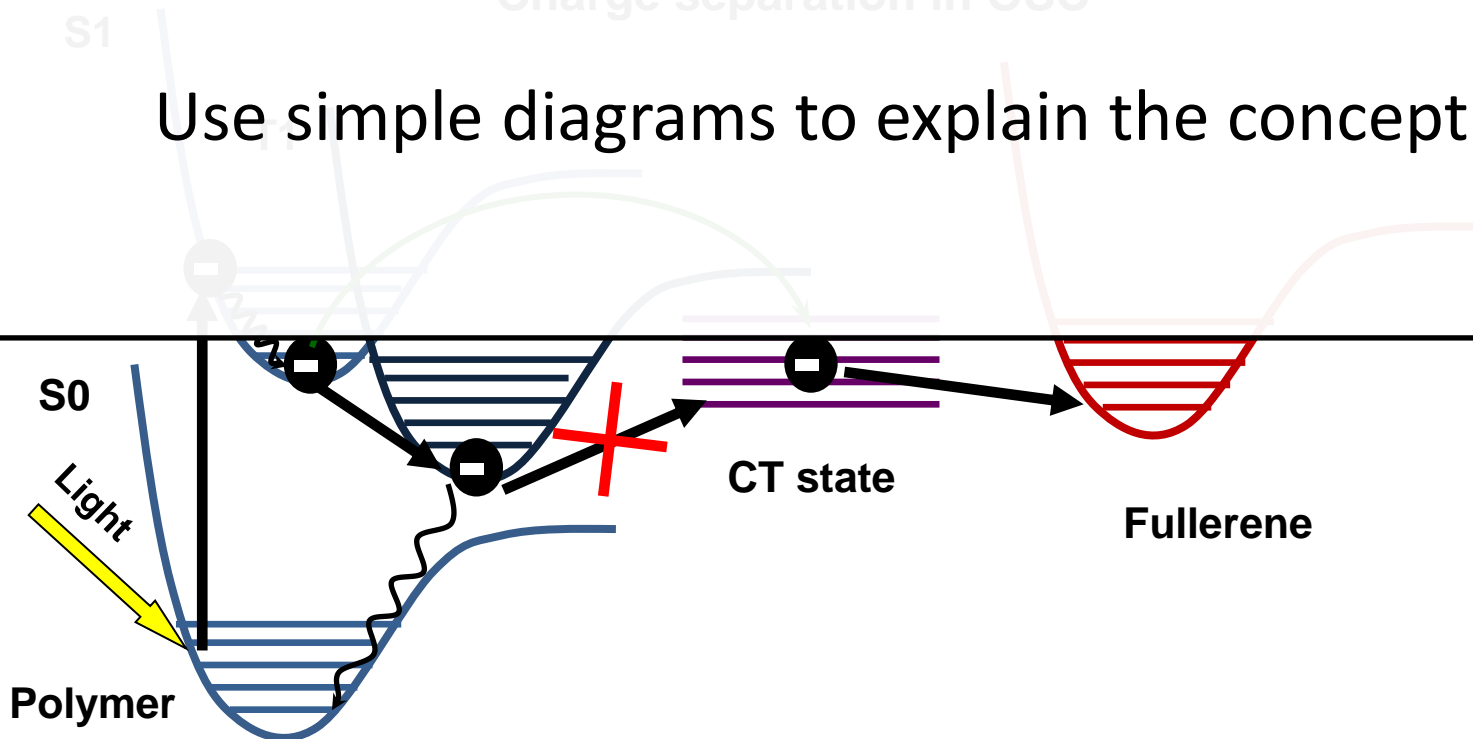


- Ease of manufacturing
- Semitransparency
- Flexibility

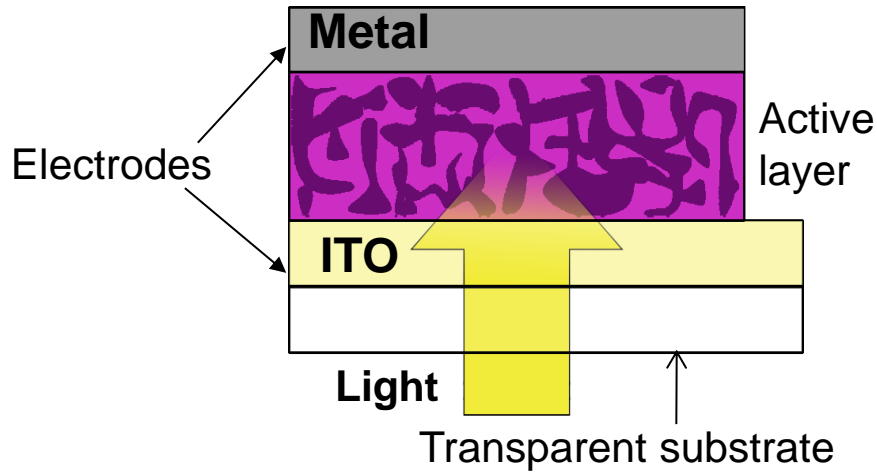
Transparent substrate

Charge separation in OSC

Use simple diagrams to explain the concept

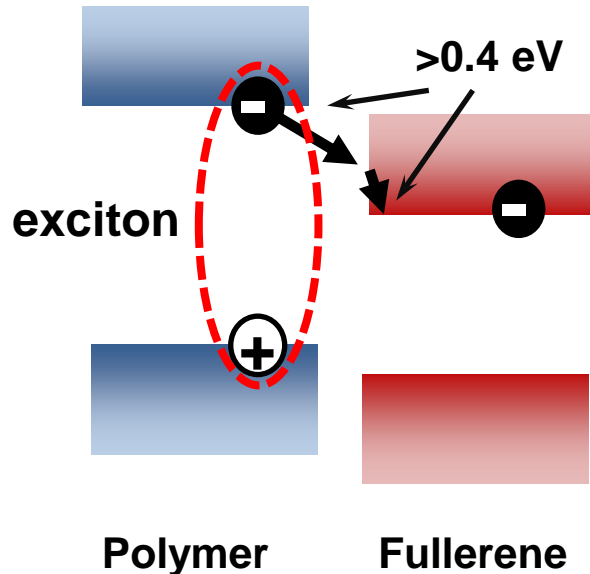


Photophysics of Organic Solar Cells



- Ease of manufacturing
- Semitransparency
- Flexibility

Charge separation in OSC



Energy gradient of ~ 0.4 eV
is needed
to dissociate the **exciton**

Corrected version

Bulk Heterojunction Concept

The goals of bulk heterojunction (BHJ) are:

- In organic materials, the exciton binding energy is high ($\gg kT$). Energy gradient is needed for exciton dissociation. BHJ is a mixture of two materials with different workfunctions \rightarrow the gradient is provided at the interface
- The exciton diffusion length in organic materials is relatively small (~ 10 nm). The phase separation in the BHJ has to be fine enough to ensure efficient exciton harvesting
- The separated charges need to be delivered to the electrodes. BHJ has to provide the pathways for the charges

Bulk Heterojunction Concept

The goals of bulk heterojunction (BHJ) are:

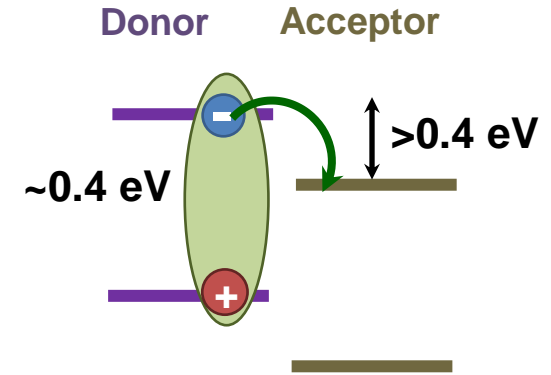
- In organic materials, the exciton binding energy is high ($\gg kT$). Energy gradient is needed for exciton dissociation. BHJ is a mixture of two materials with different workfunctions \rightarrow the gradient is provided at the interface

Avoid bullet points - opt for word tables (~10 nm).

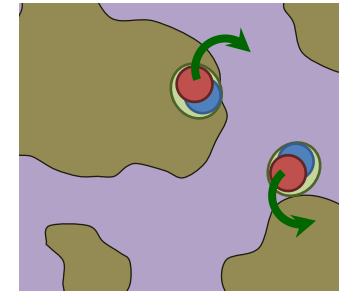
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Bulk Heterojunction Concept

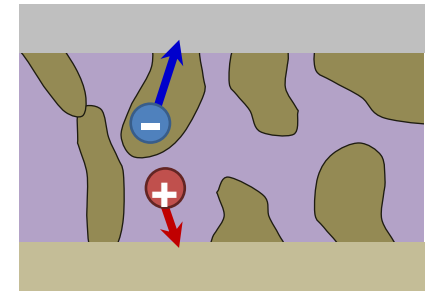
- 1) Exciton binding energy ~ 0.4 eV ($\gg kT$) \rightarrow
Energy gradient is needed to split the exciton \rightarrow
Interface with acceptor material;



- 2) Fine (<10 nm) **intermixing** of the two materials is needed because of small exciton diffusion length



- 3) Charge transport to the electrodes

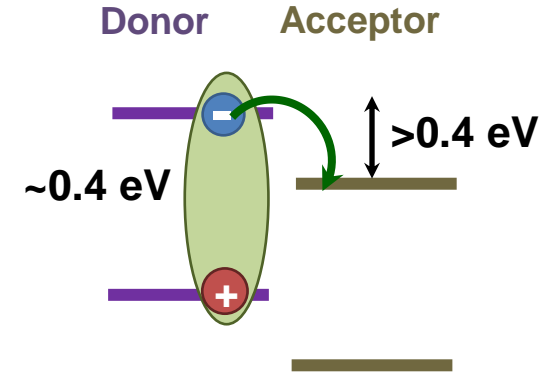


Bulk Heterojunction is a **donor:acceptor** blend with **fine (<10 nm) phase separation**

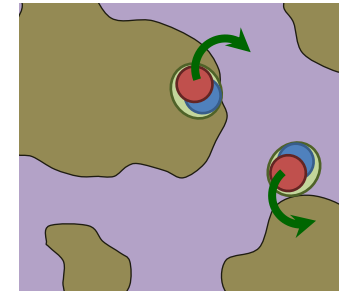
Corrected version

Bulk Heterojunction Concept

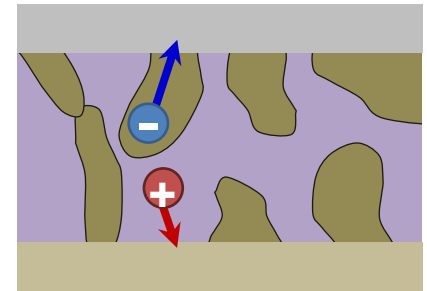
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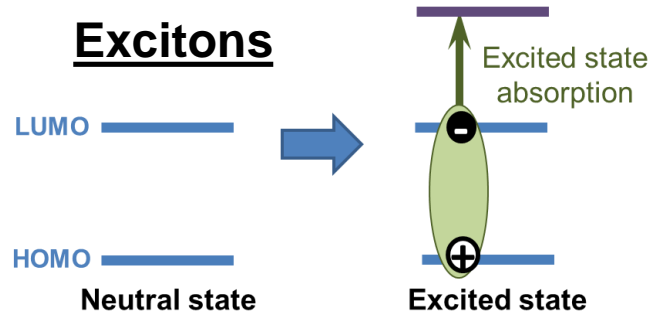


Bulk Heterojunction is a **donor:acceptor** blend with **fine (< 10 nm) phase separation**

Corrected version

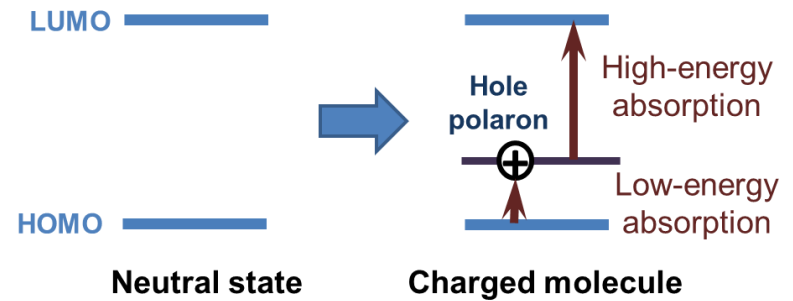
Photoinduced Absorption

Concept:

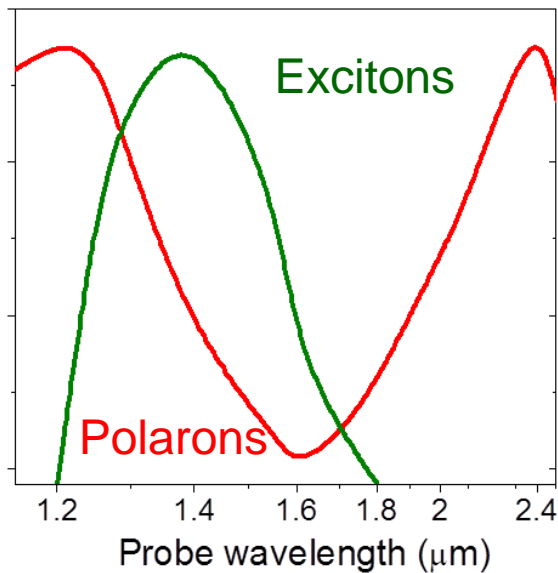


Charges

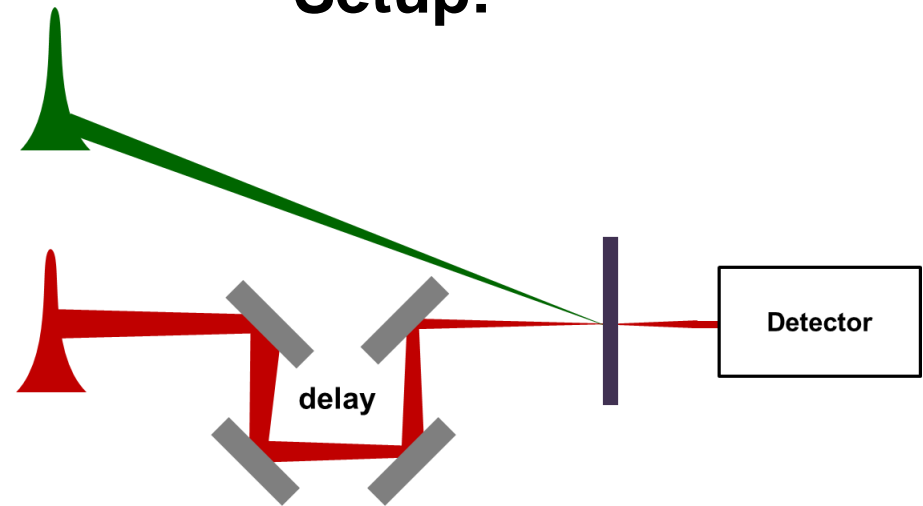
Only **species on donor** are observable



Spectra:



Setup:

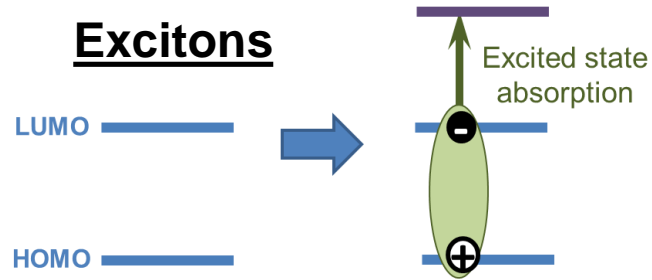


$$\frac{\Delta T}{T} \propto N$$

Initial version

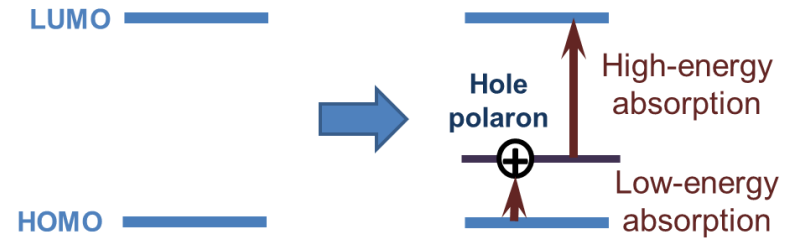
Photoinduced Absorption

Concept:



Charges

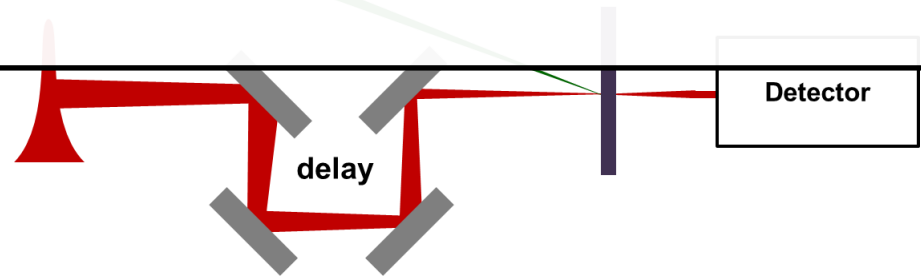
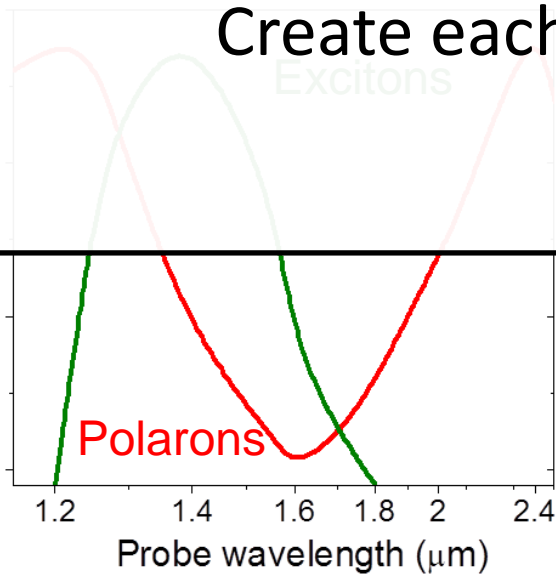
Only **species on donor** are observable



Neutral state Excited state Neutral state Charged molecule

Spectra: **Setup:**

Create each slide as a single message unit

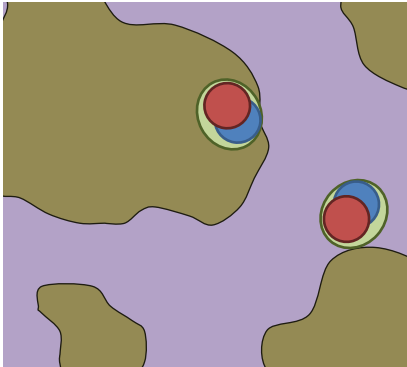


$$\frac{\Delta T}{T} \propto N$$

Concept of Photoinduced Absorption (PIA)

Species to observe:

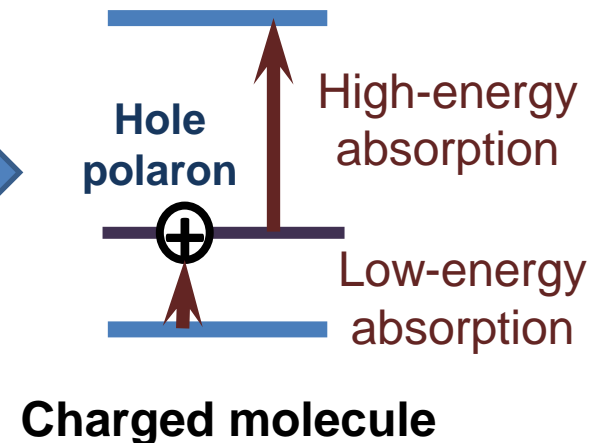
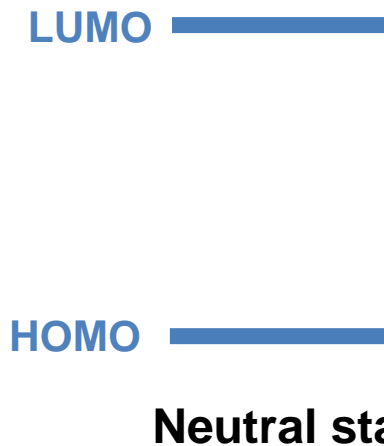
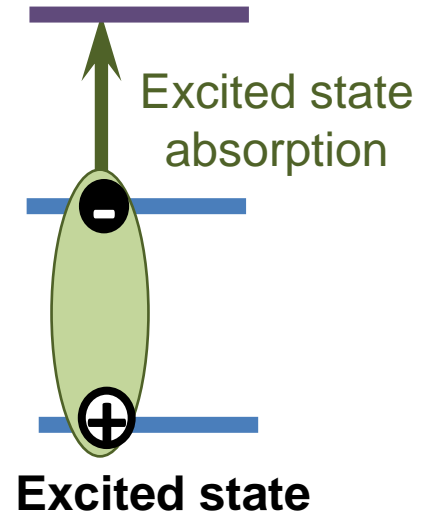
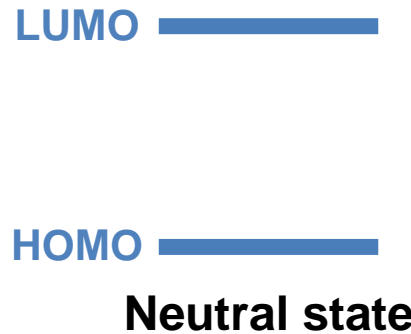
Excitons



Charges



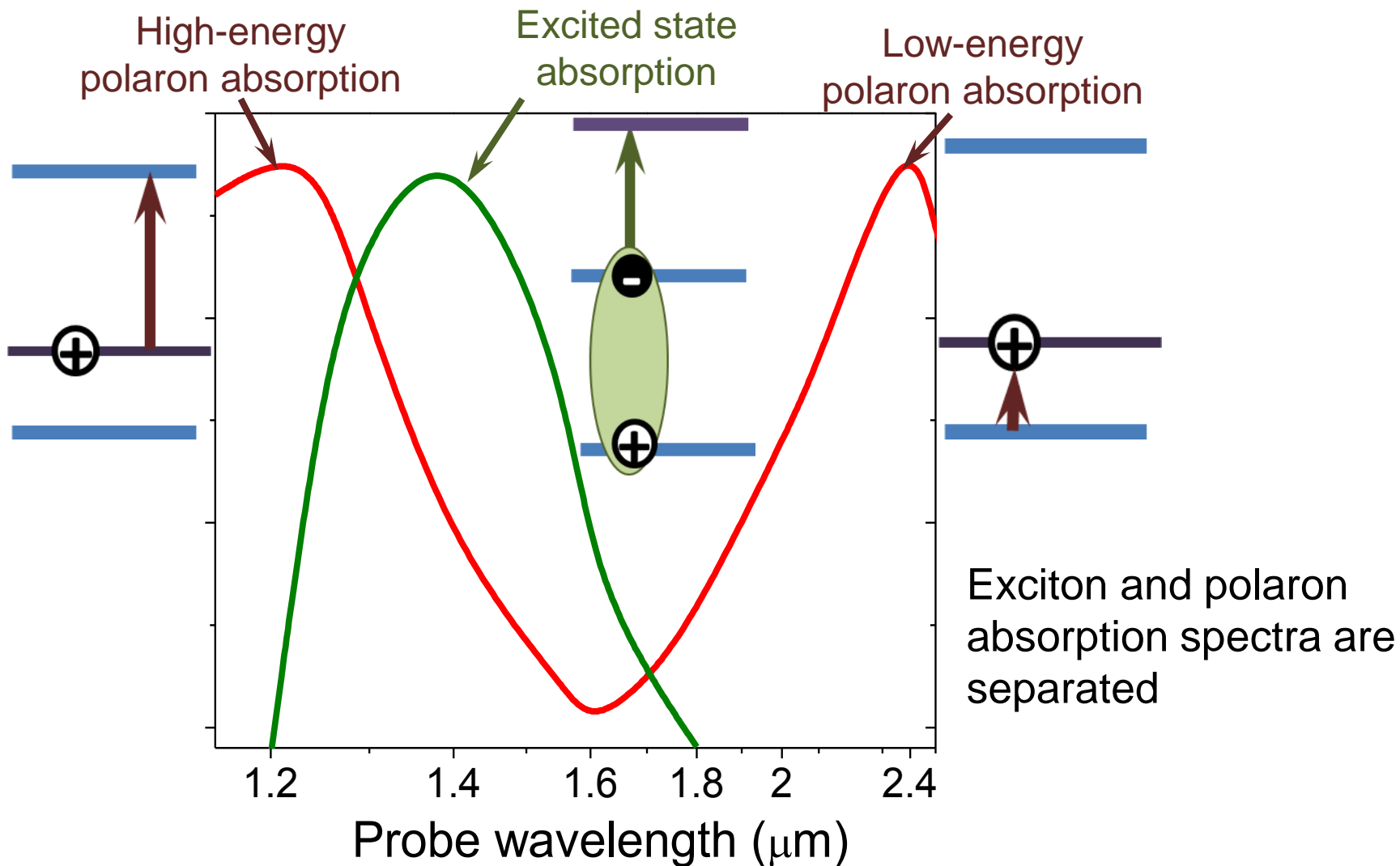
Energy diagrams:



Only **charges on donor** are observable

Corrected version

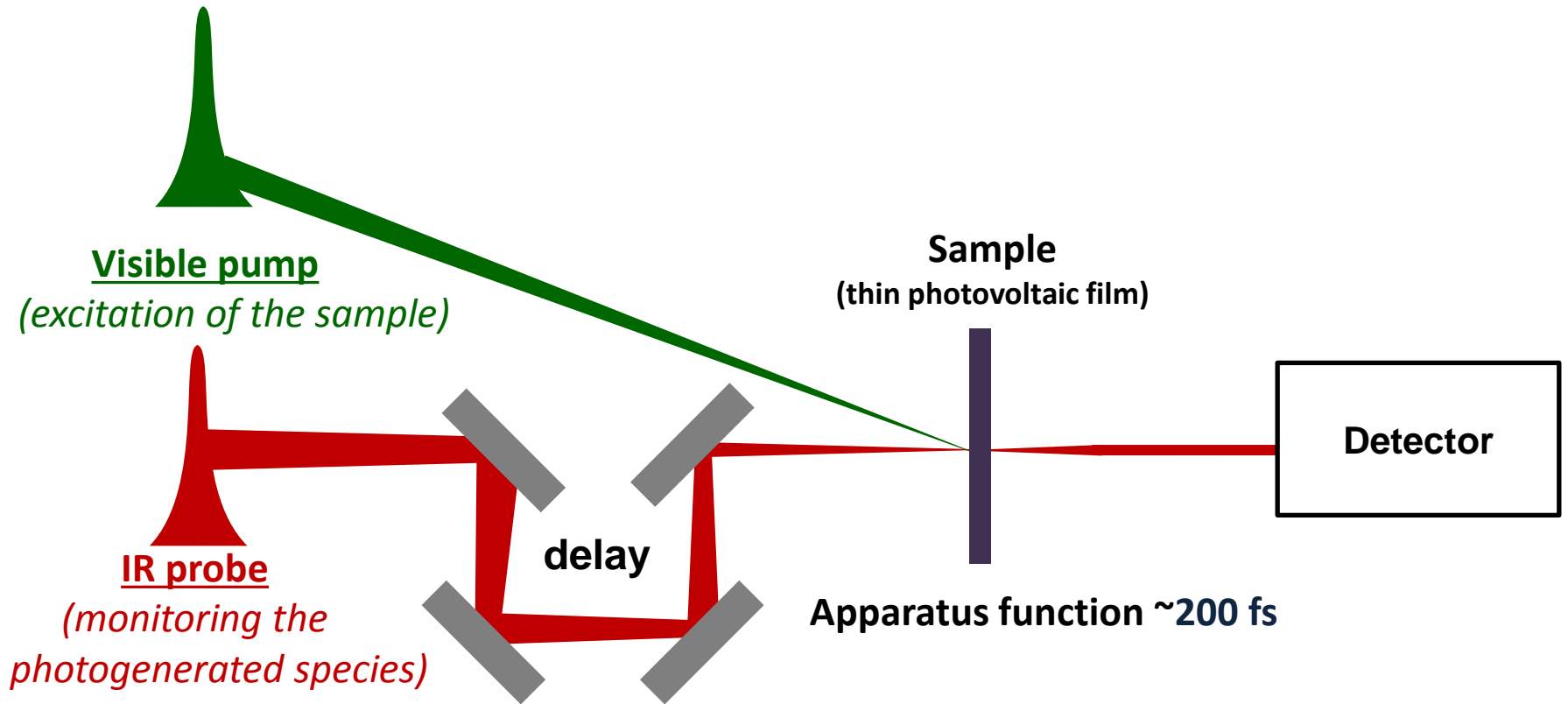
Representative PIA Spectrum



Different spectral probes observe different

Corrected version

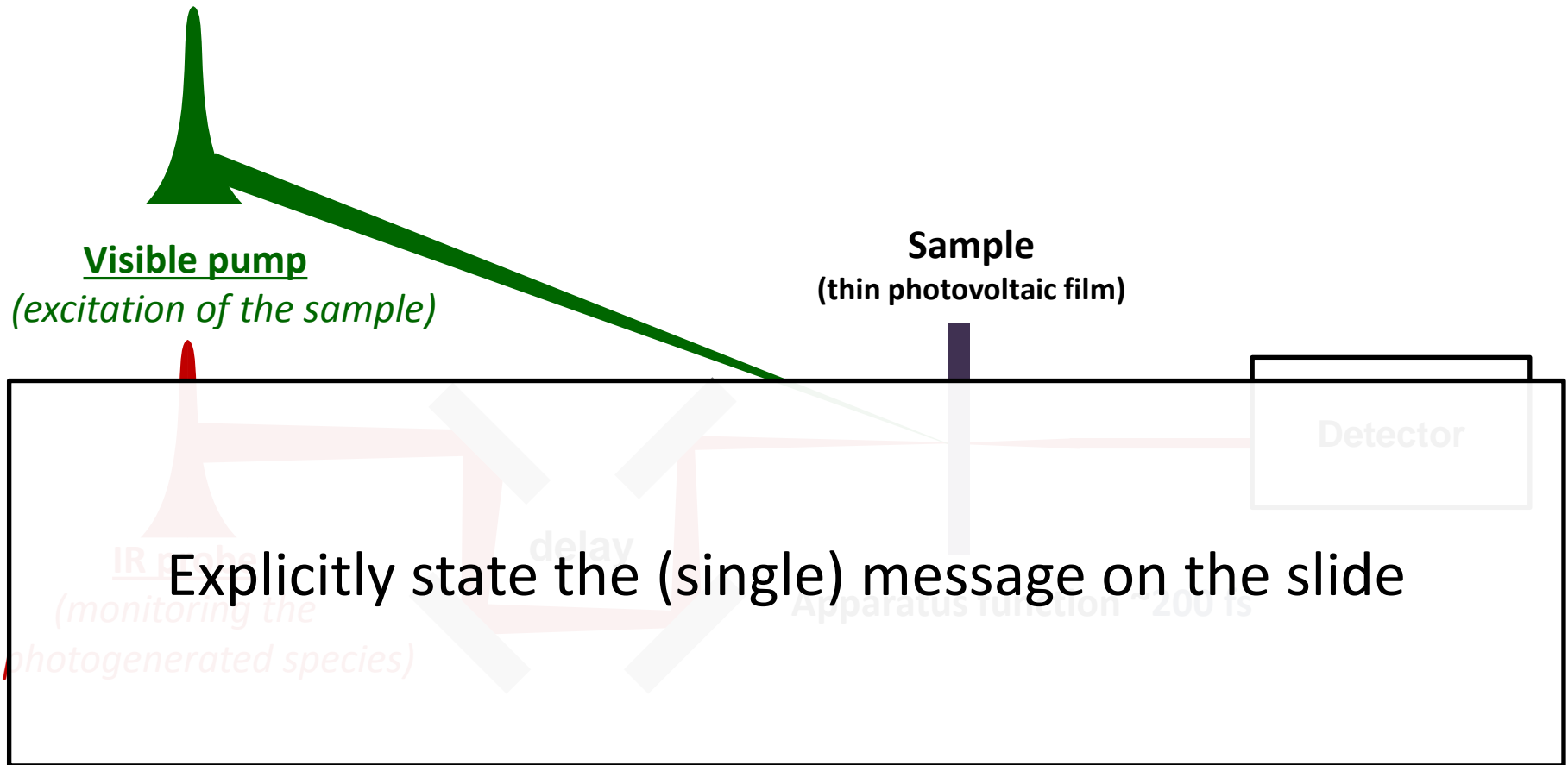
Experimental Setup



$$\frac{\Delta T}{T} \propto N$$

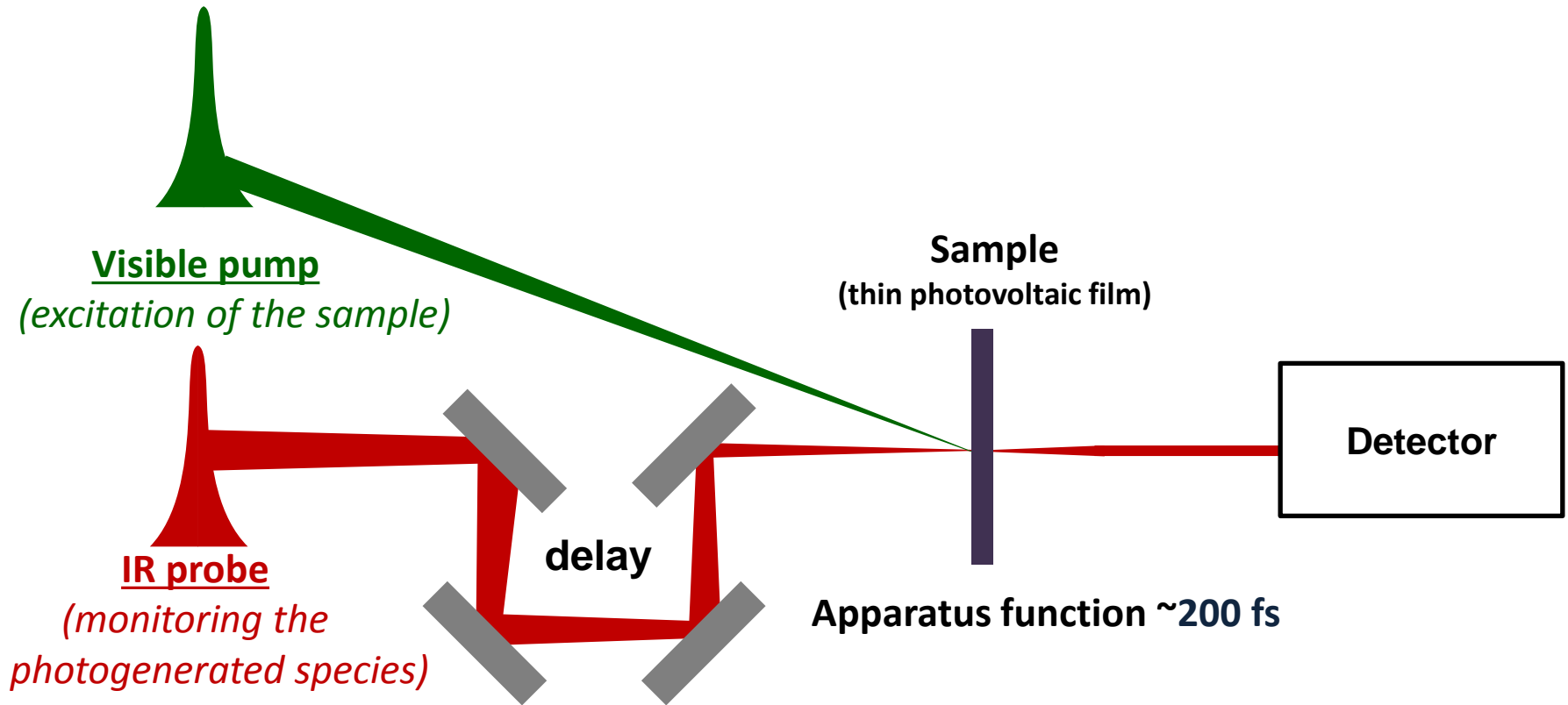
Corrected (?) version

Experimental Setup



$$\frac{\Delta T}{T} \propto N$$

Experimental Setup

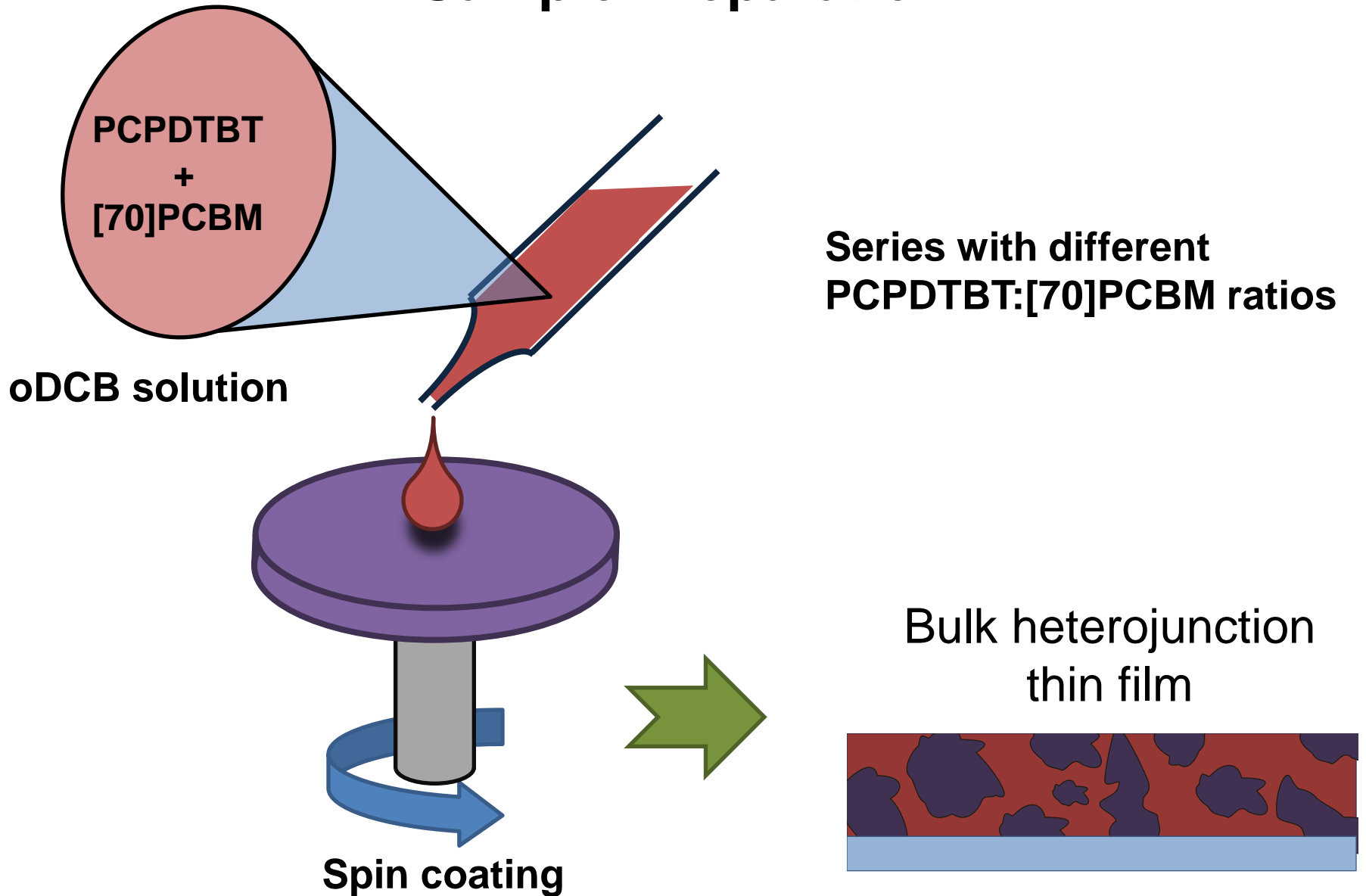


$$\frac{\Delta T}{T} \propto N$$

Change in transmission is proportional to the number of charges

Corrected version

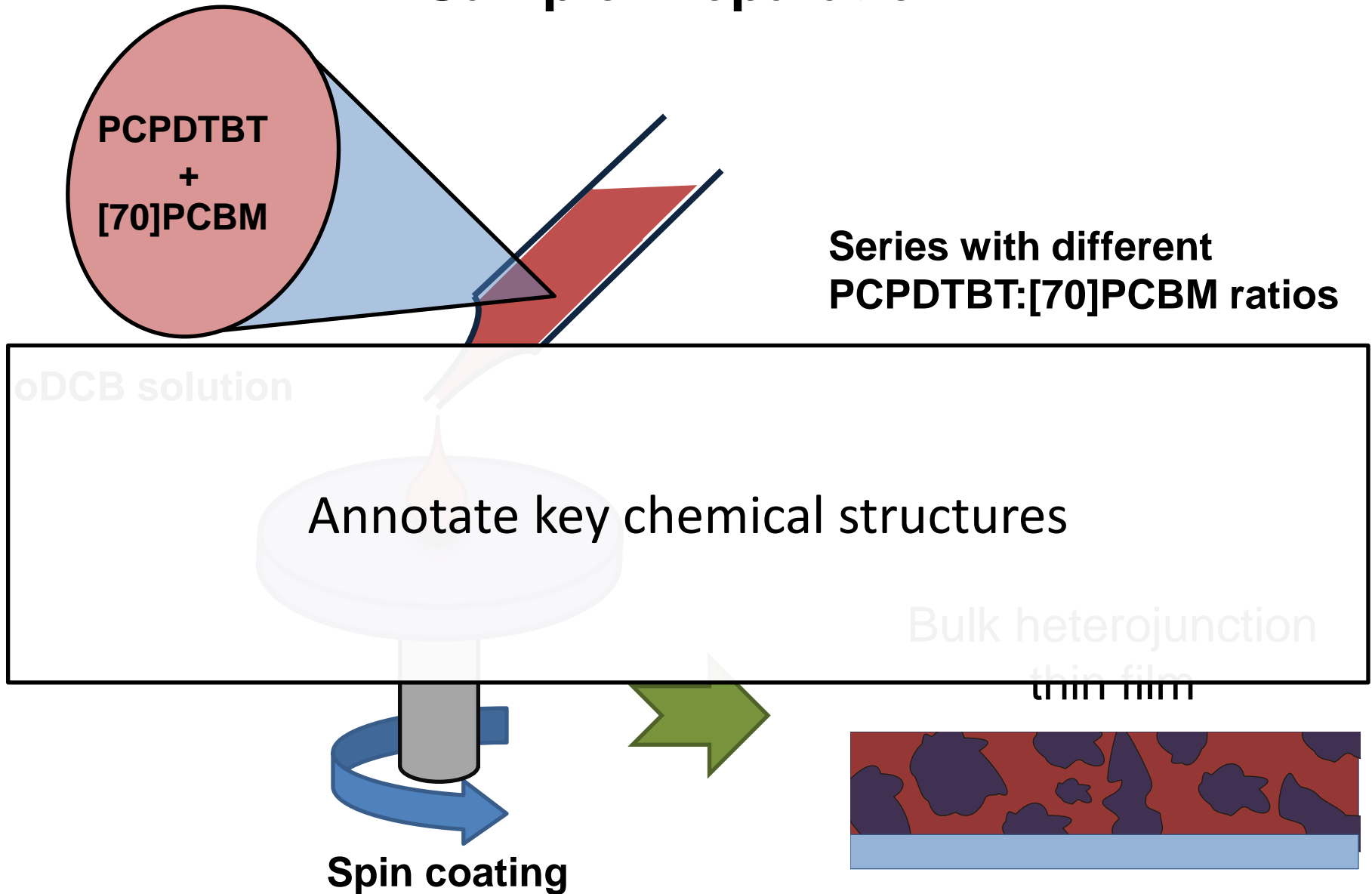
Sample Preparation



Devices are also possible: spectroscopy

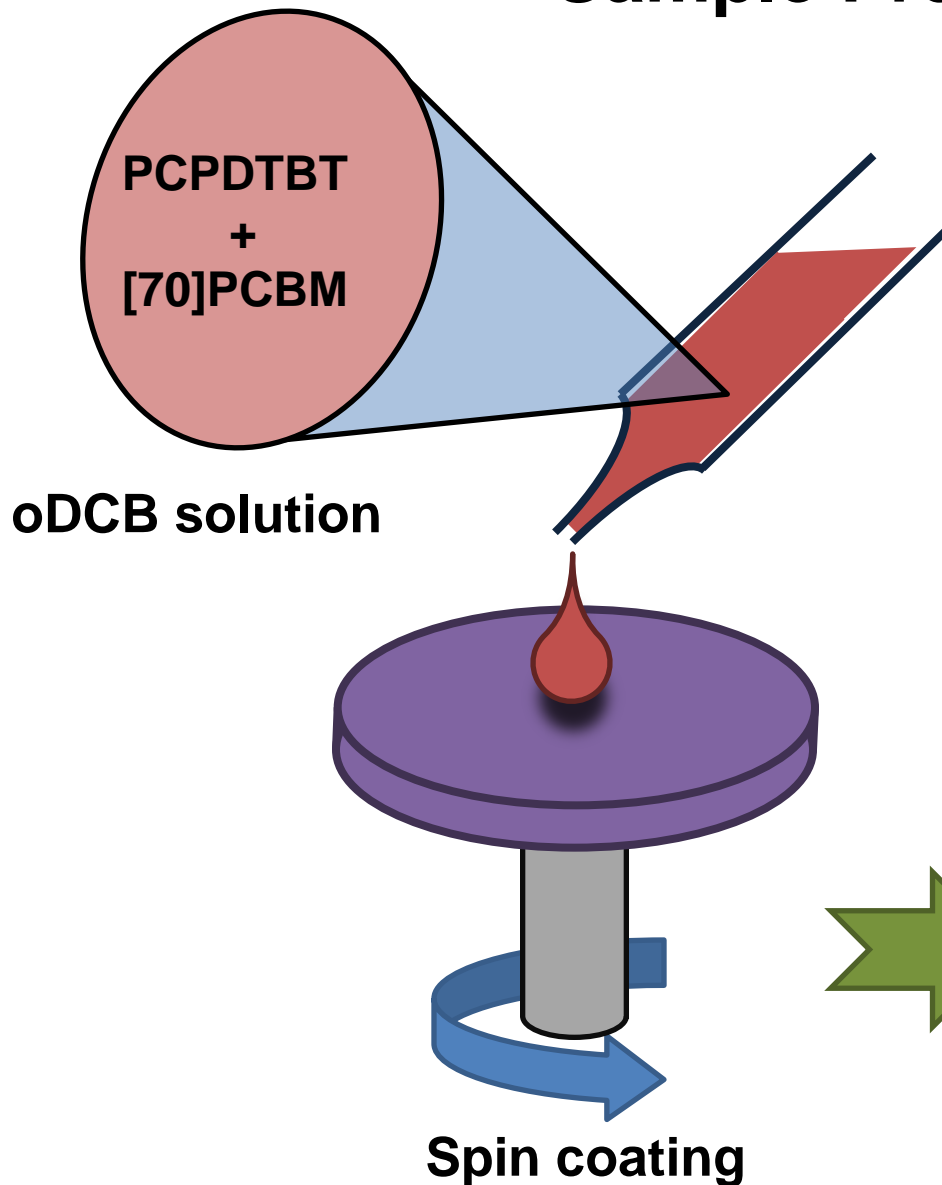
Initial version

Sample Preparation

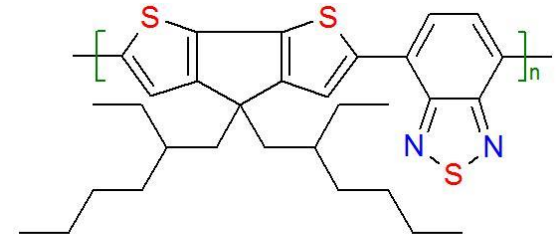


Devices are also possible: spectroscopy is non-invasive

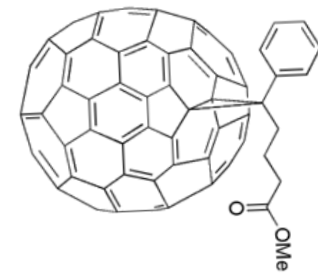
Sample Preparation



Donor: PCPDTBT



Acceptor: [70]PCBM



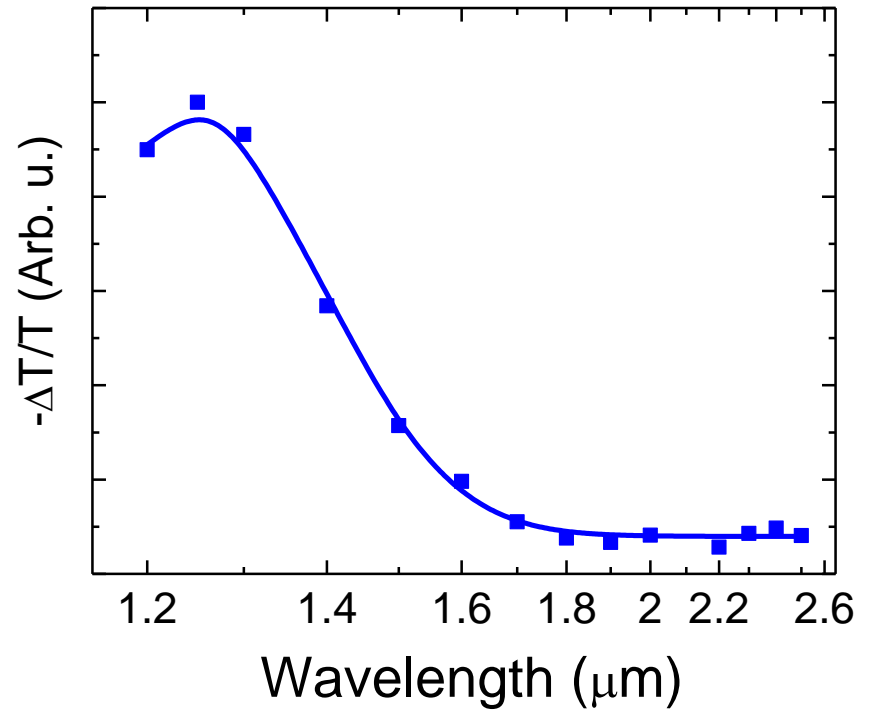
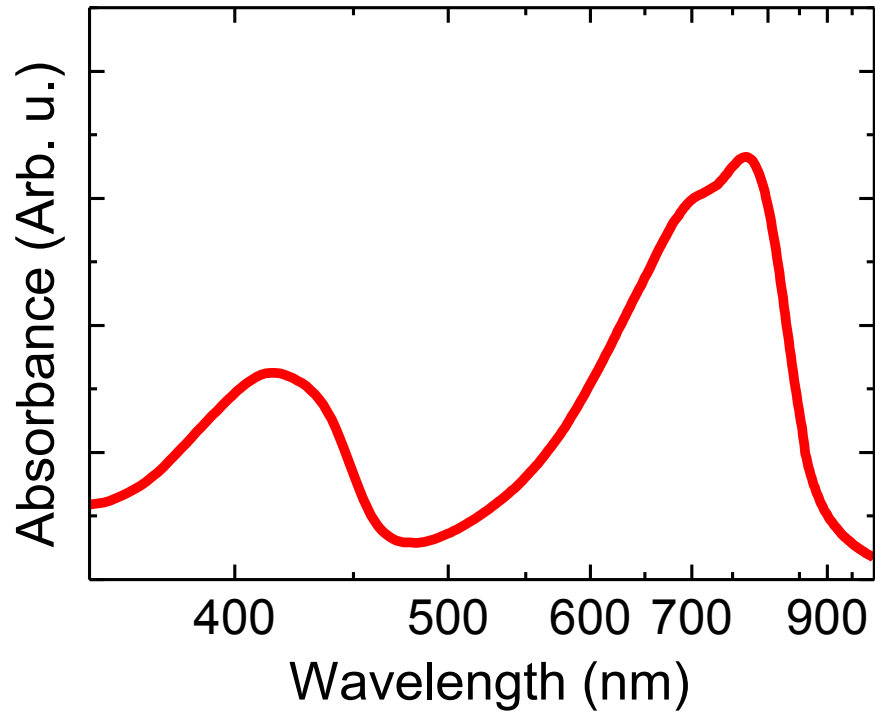
Bulk heterojunction thin film



Devices are also possible: spectroscopy

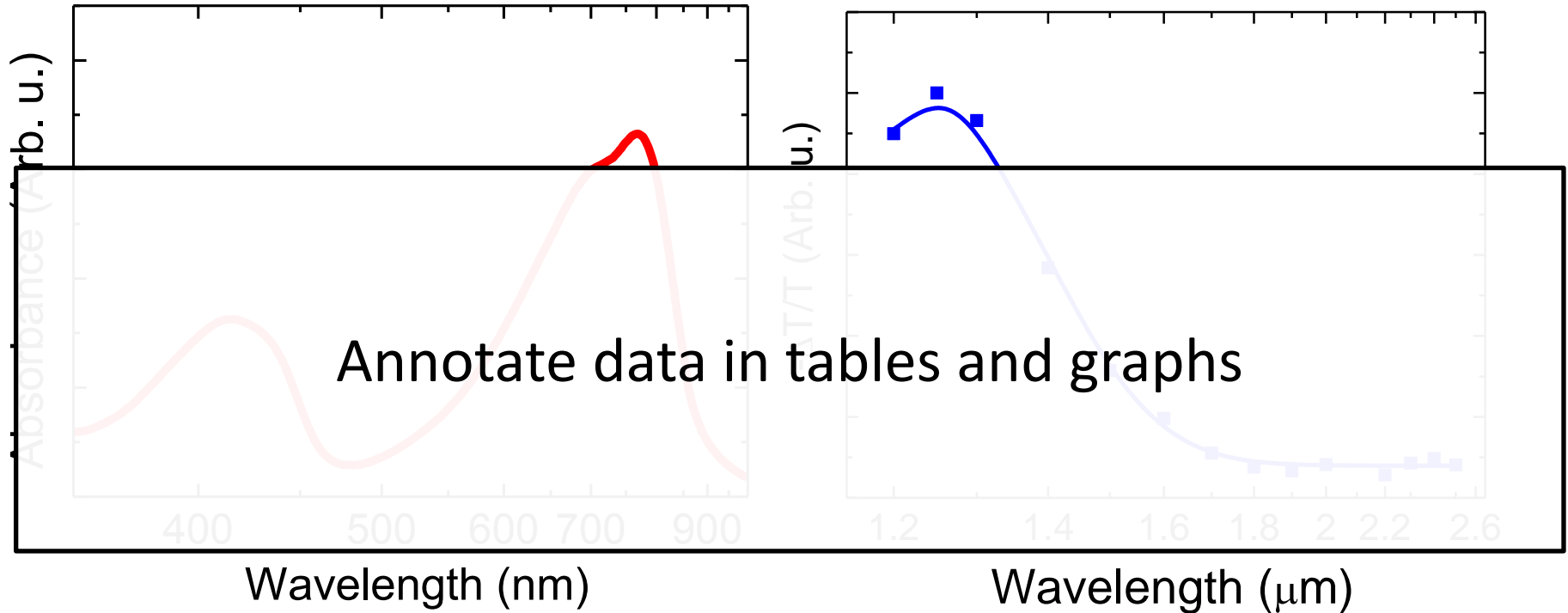
Corrected version

Experimental conditions



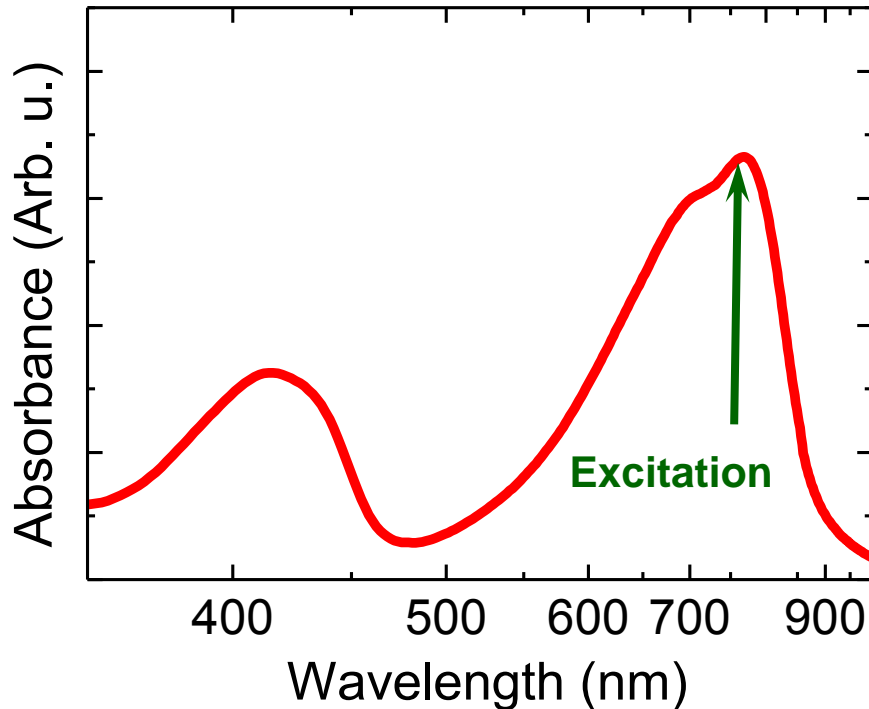
Initial version

Experimental conditions



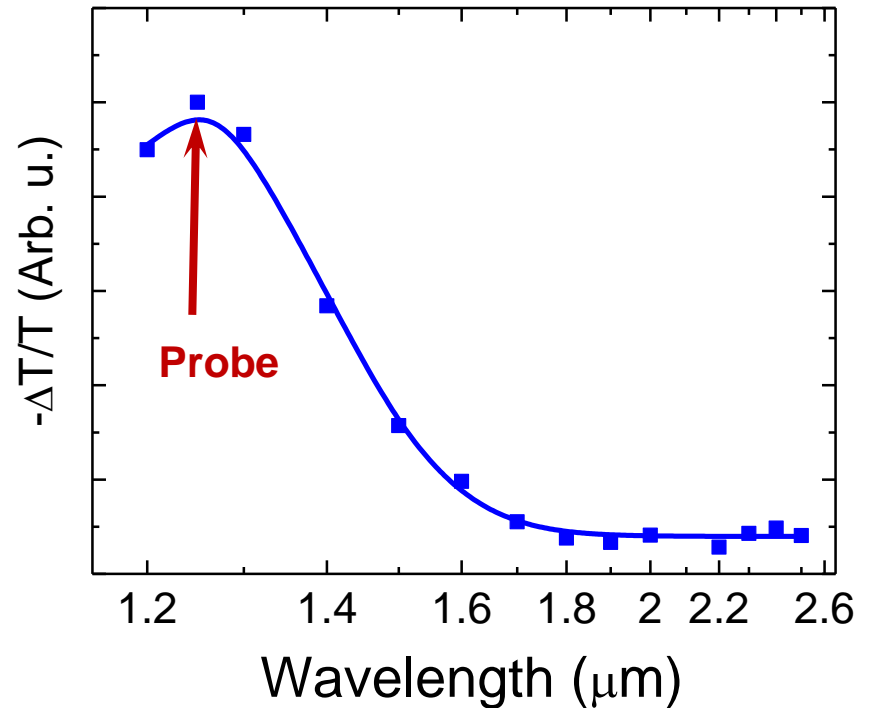
Choosing Excitation and Probe Wavelengths

Linear absorption spectrum



Excitation wavelength 750 nm

Polaron absorption spectrum



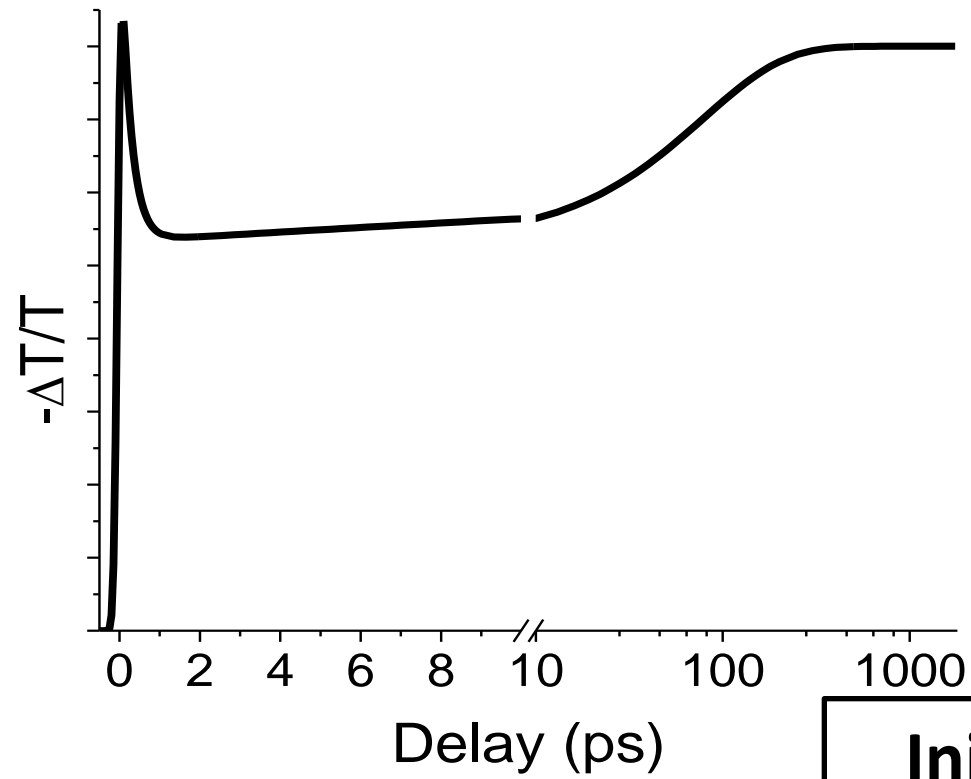
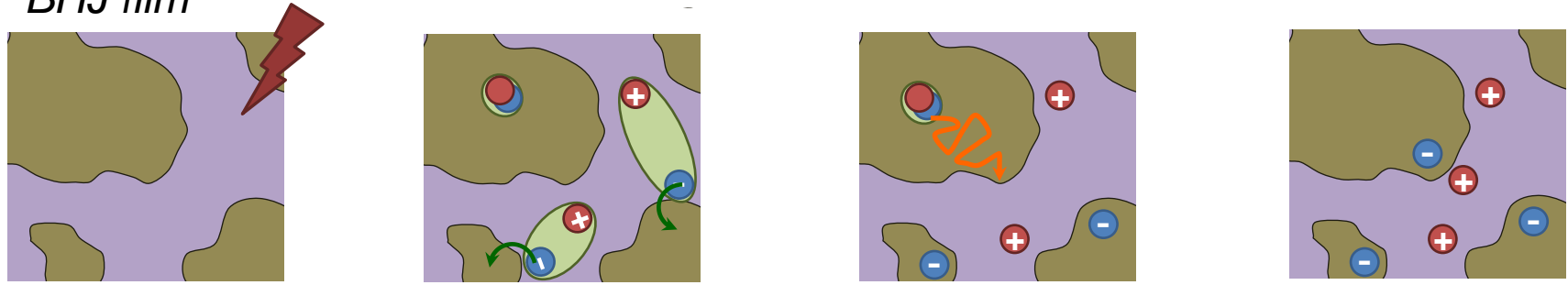
Probe wavelength 1.25 μm

Excitation/probe wavelengths are set at absorption maxima

Corrected version

Charge Dynamics in Organic Solar Cells

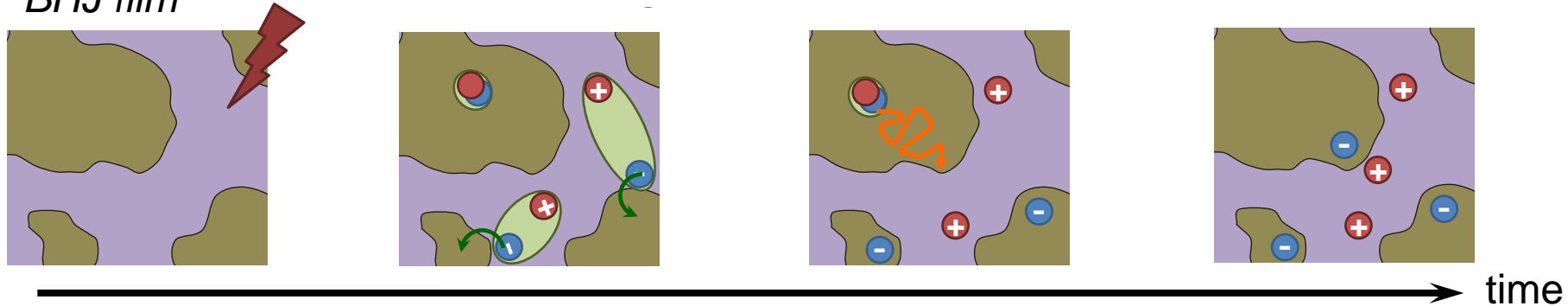
BHJ film



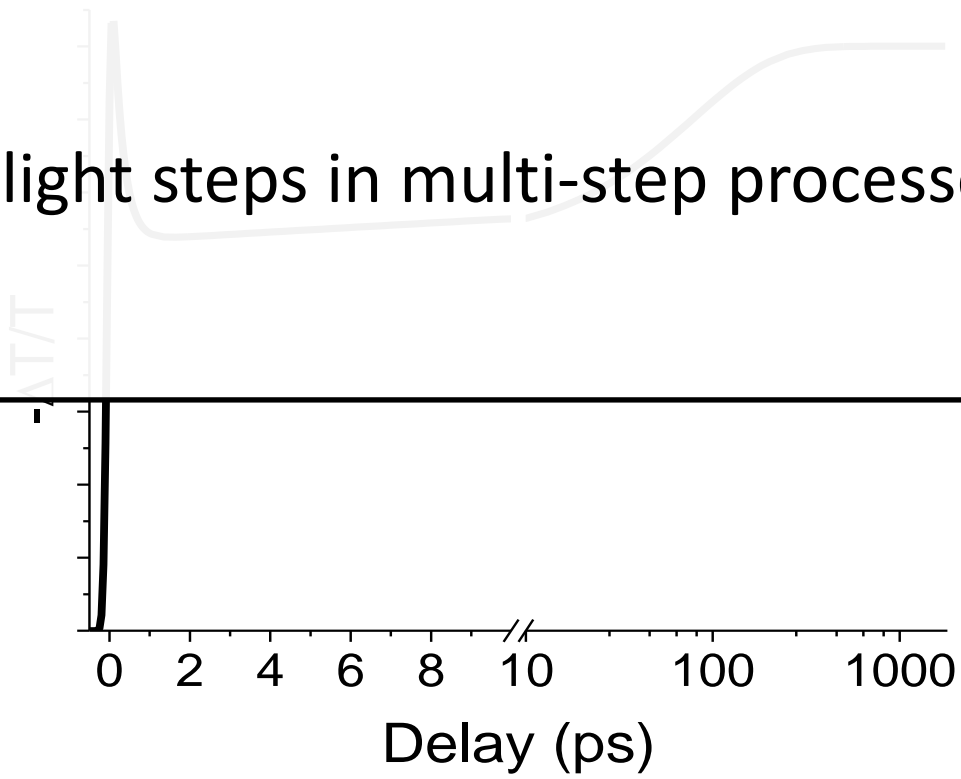
Initial version

Charge Dynamics in Organic Solar Cells

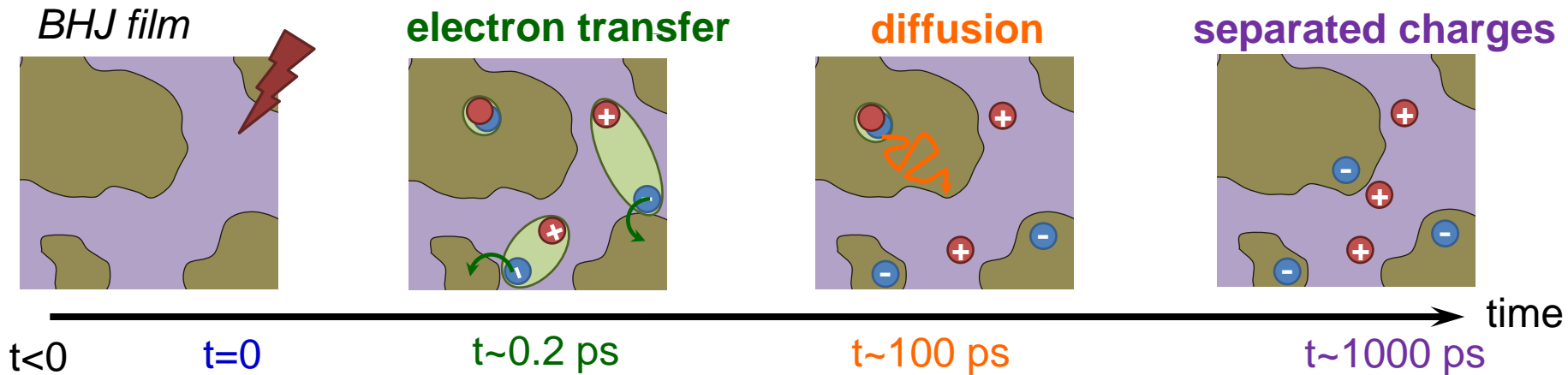
BHJ film



Highlight steps in multi-step processes



Charge Dynamics in Organic Solar Cells



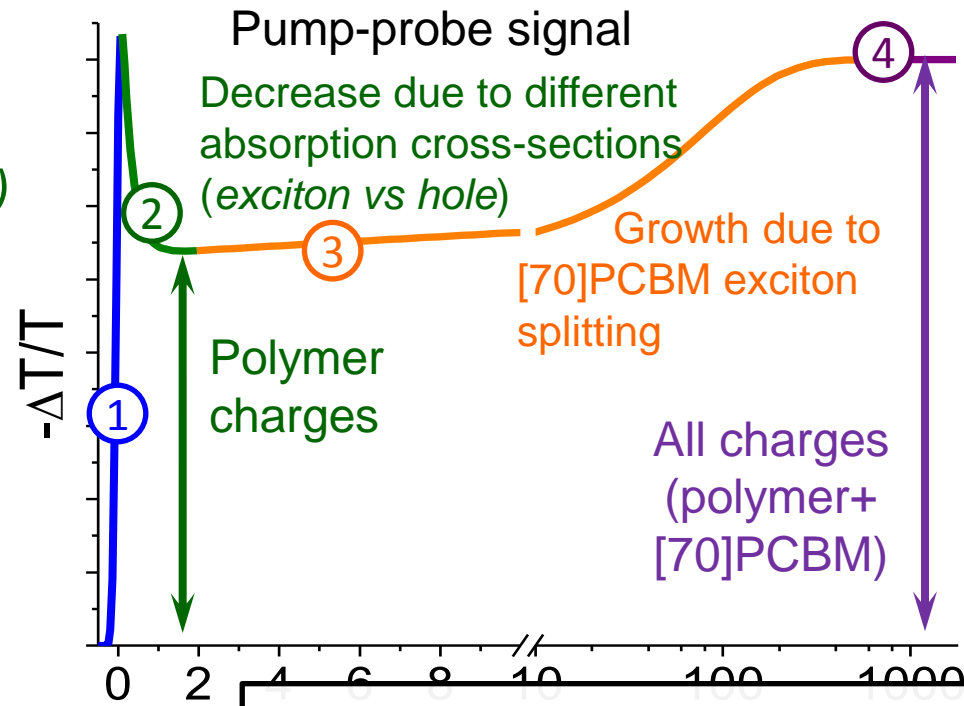
1 Exciton formation

2 Exciton splitting (*electron transfer*)

3 [70]PCBM exciton diffusion +dissociation (*hole transfer*)

4 All excitons are dissociated

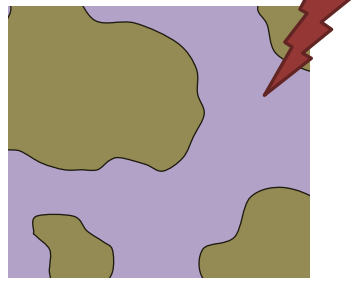
PIA allows to follow exciton and charge dynamics processes



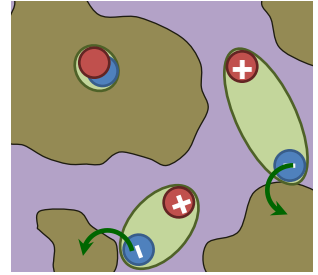
Corrected (?) version

Charge Dynamics in Organic Solar Cells

BHJ film



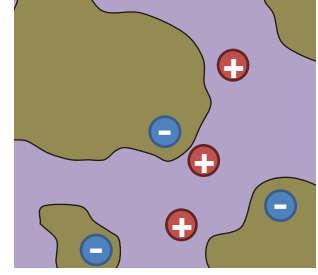
electron transfer



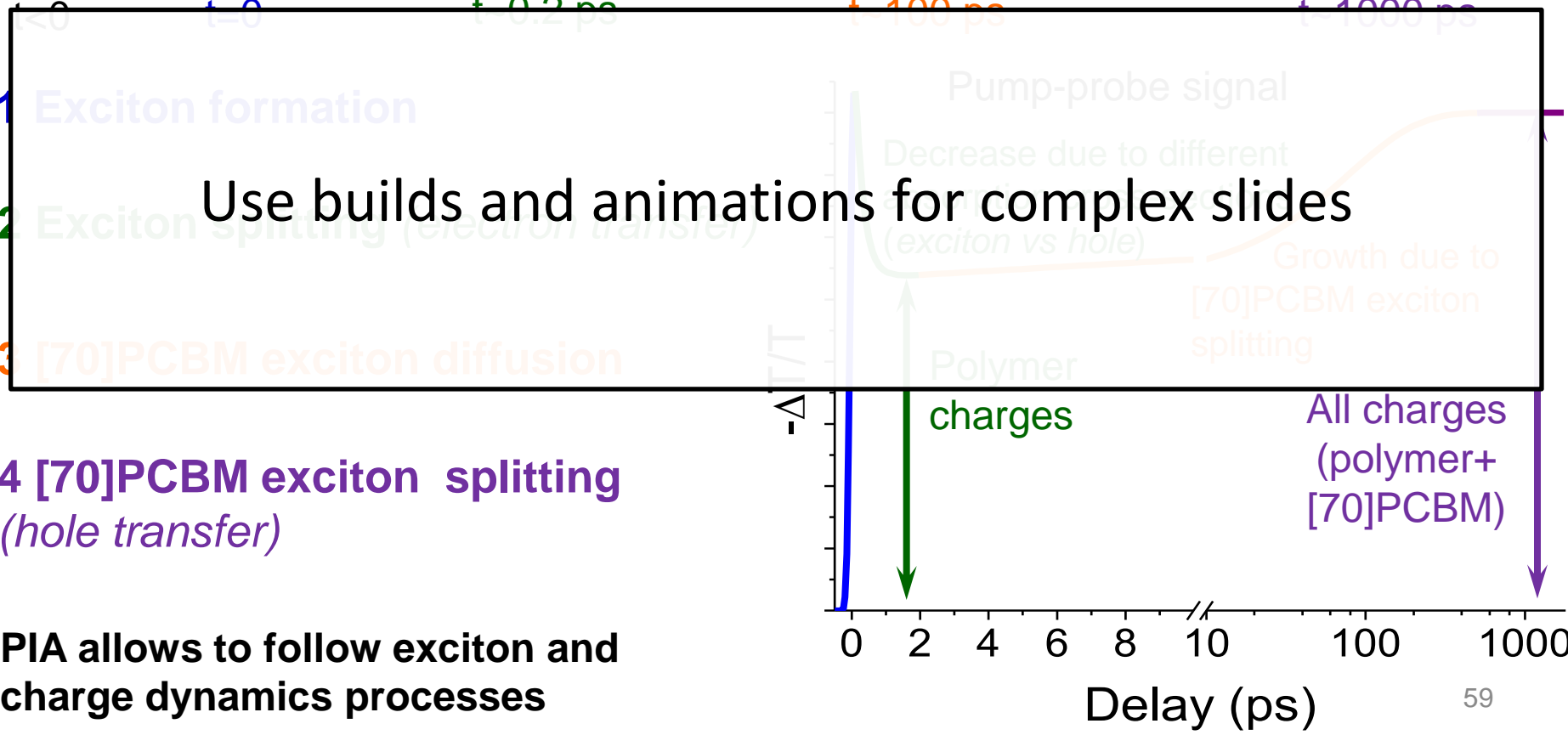
diffusion



separated charges

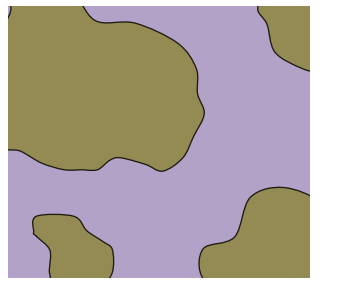


time →



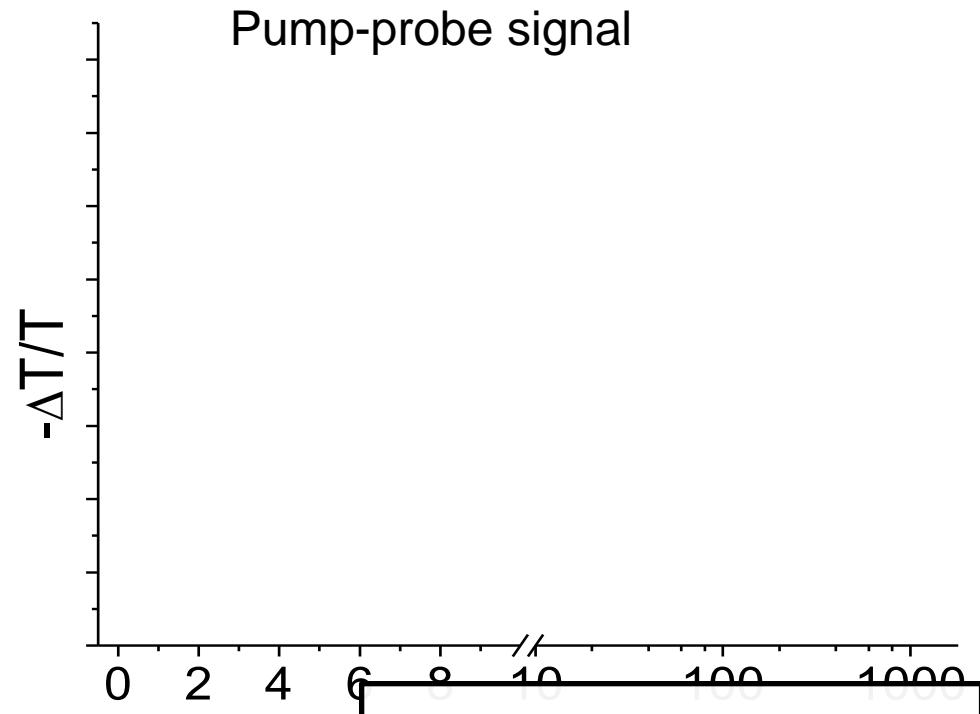
Charge Dynamics in Organic Solar Cells

BHJ film



time

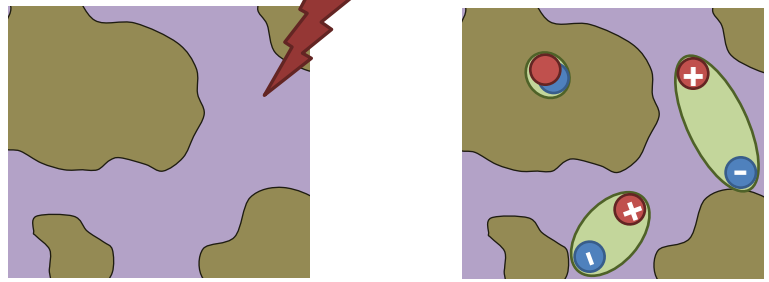
t<0



Corrected version

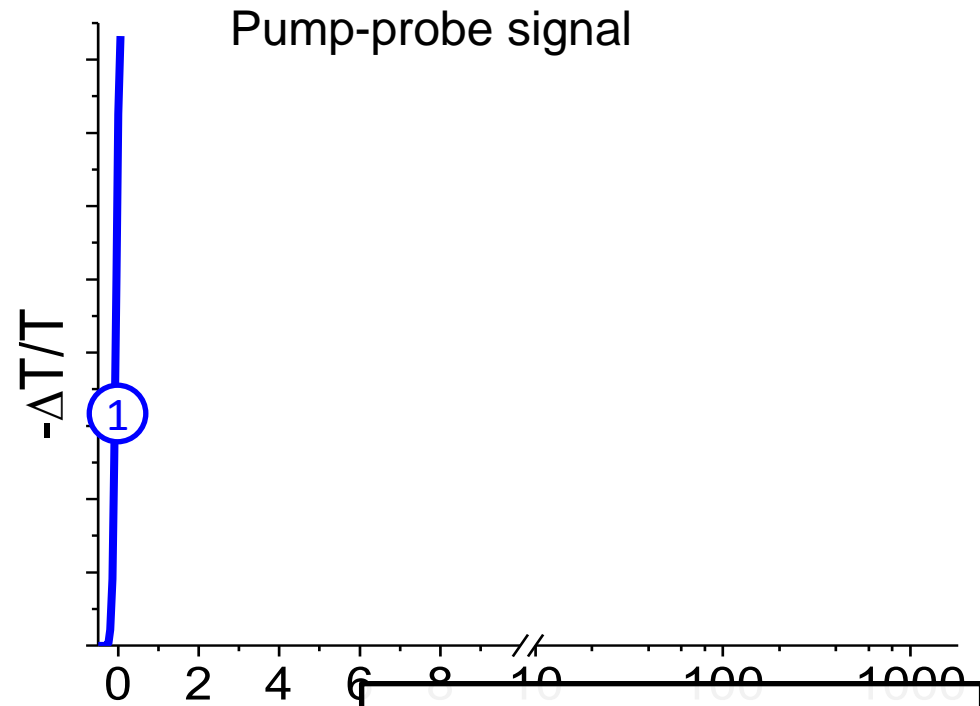
Charge Dynamics in Organic Solar Cells

BHJ film



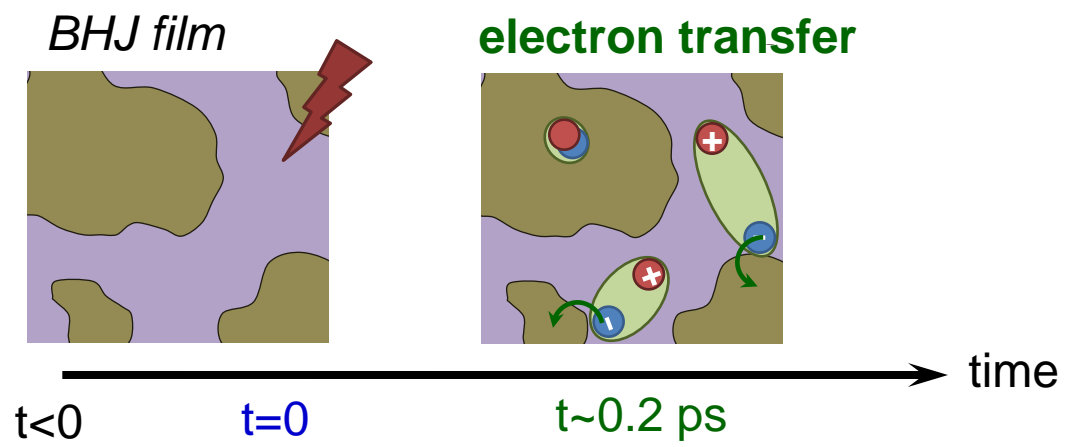
t < 0 t = 0 time

1 Exciton formation



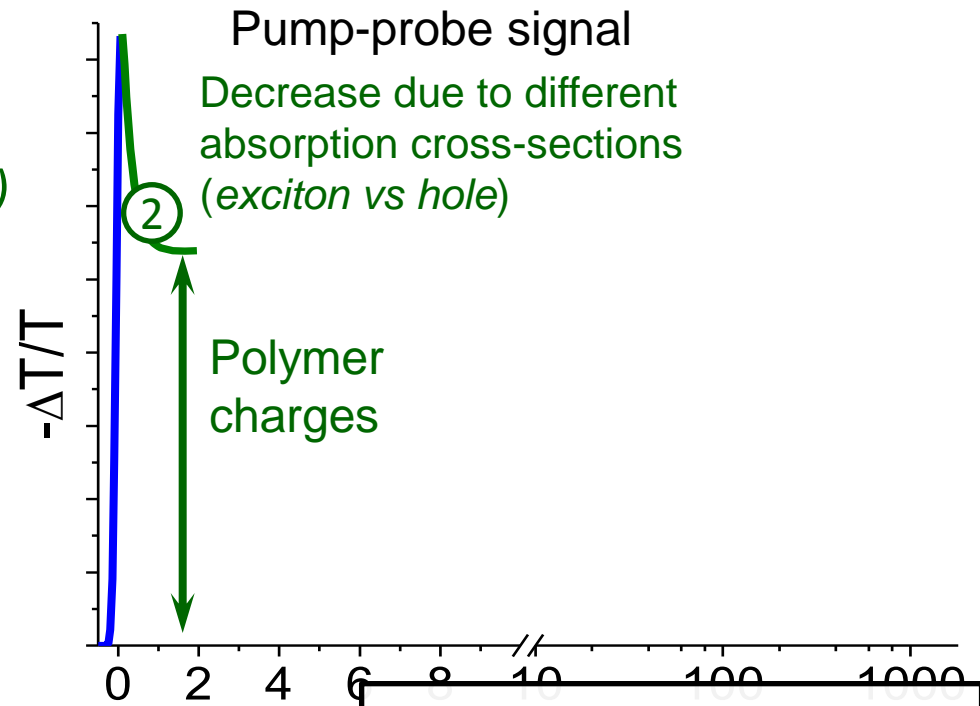
Corrected version

Charge Dynamics in Organic Solar Cells



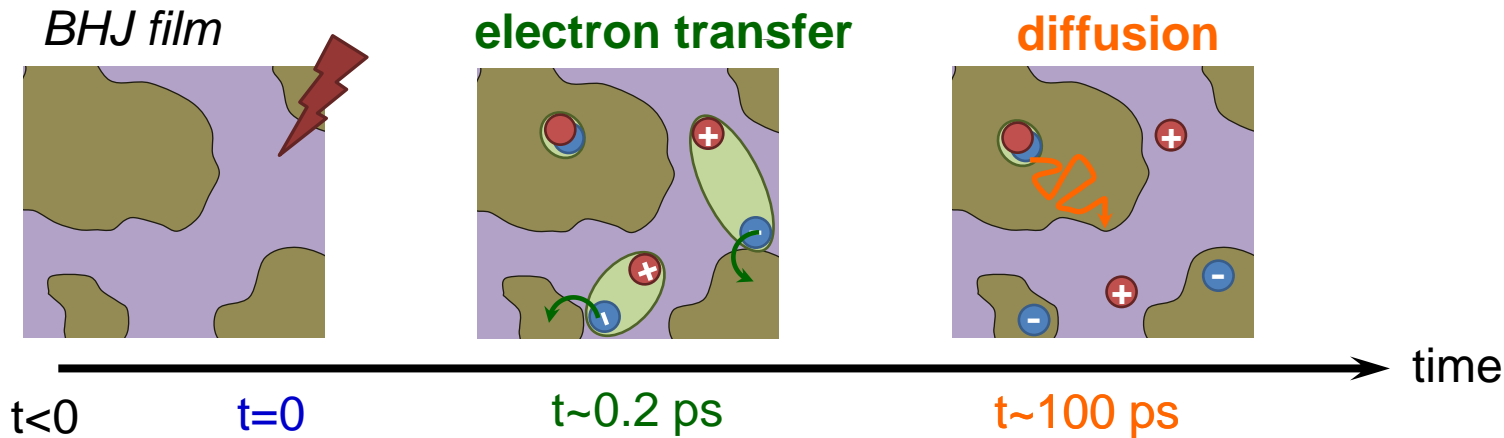
1 Exciton formation

2 Exciton splitting (*electron transfer*)



Corrected version

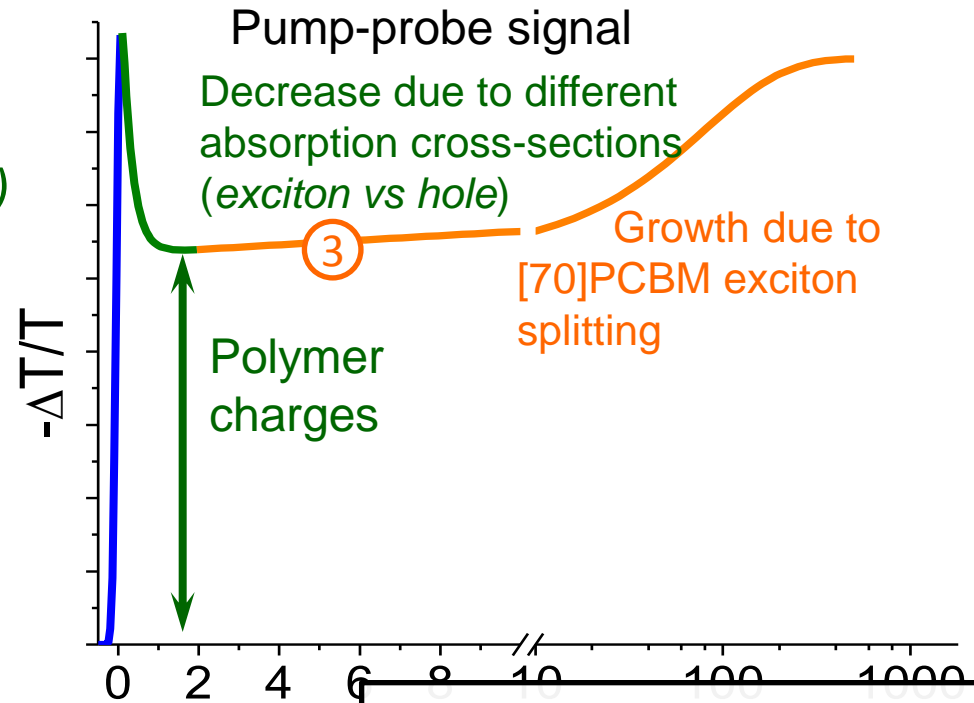
Charge Dynamics in Organic Solar Cells



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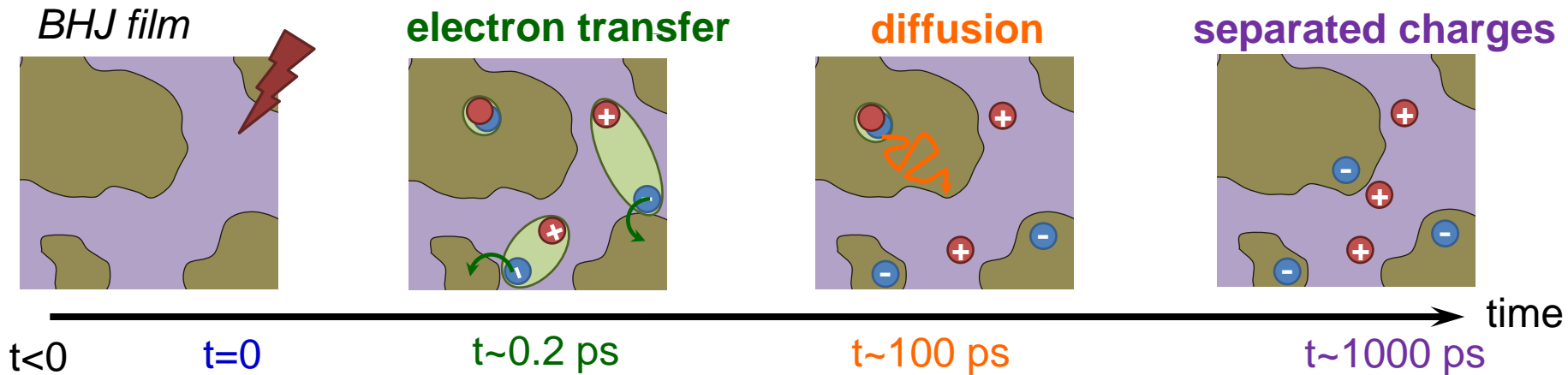
2 Exciton splitting (*electron transfer*)

3 [70]PCBM exciton diffusion +dissociation (*hole transfer*)



Corrected version

Charge Dynamics in Organic Solar Cells



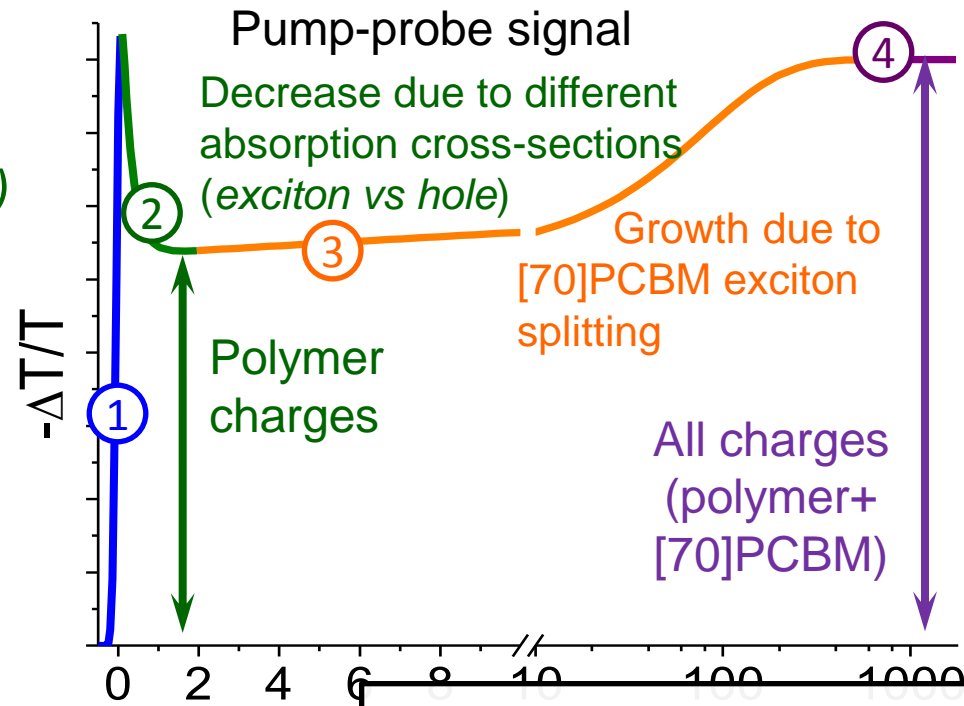
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2 Exciton splitting (*electron transfer*)

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PIA allows to follow exciton and charge dynamics processes



Conclusions

Ultrafast PIA spectroscopy provides valuable information about charge generation in photovoltaic blends:

- Instantaneous charge generation via electron transfer
- Diffusion-delayed charge generation via hole transfer

...And much more

Initial version

Conclusions

Ultrafast PIA spectroscopy provides valuable information about charge generation in photovoltaic blends:

- Instantaneous charge generation via electron transfer

Use pictorial illustrations

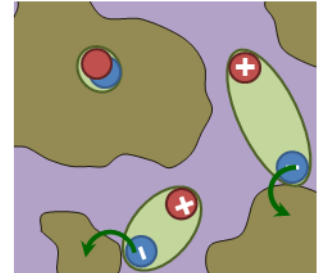
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- Instantaneous charge generation via electron transfer



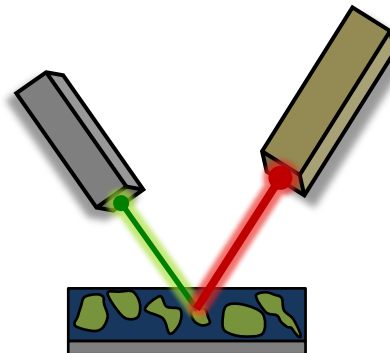
$t \sim 0.2$ ps

- Diffusion-delayed charge generation via hole transfer

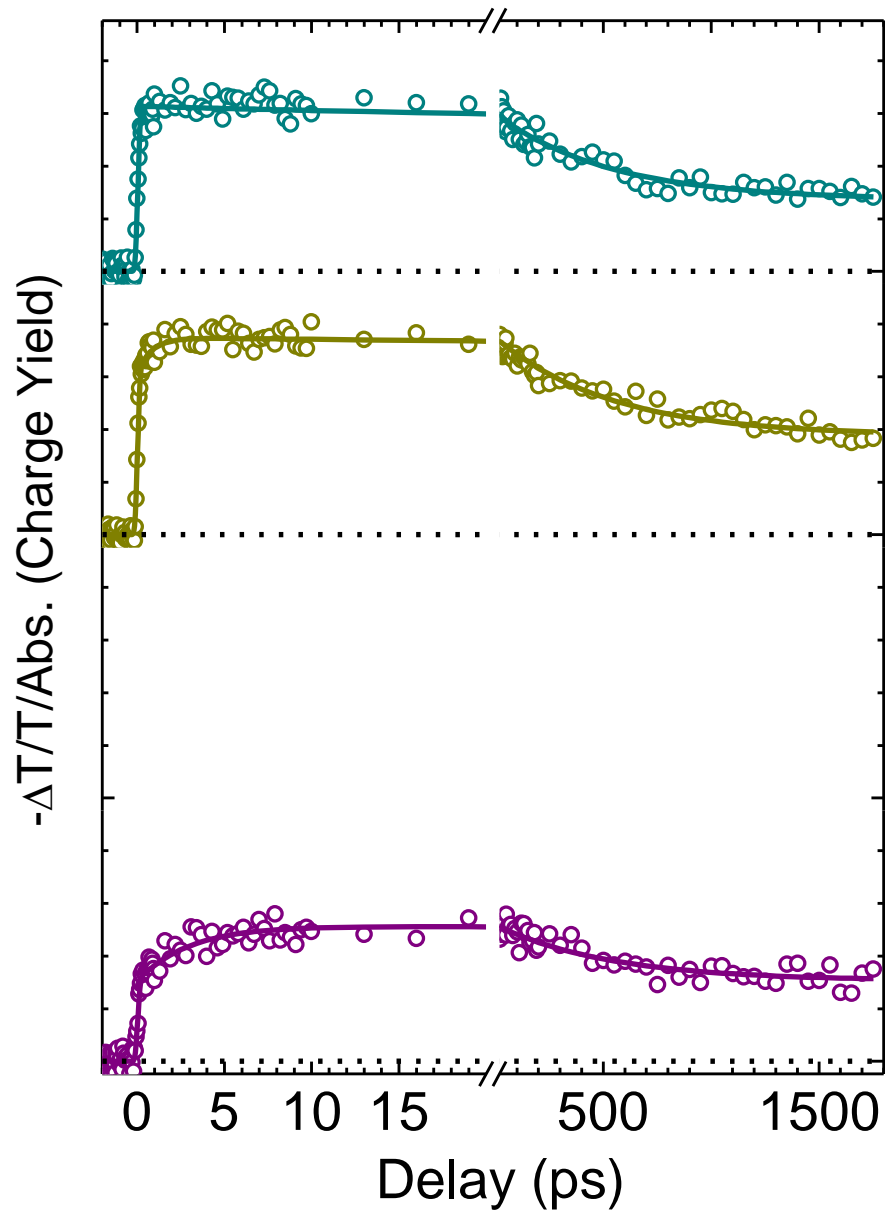


$t \sim 10-100$ ps

...And much more



Corrected version

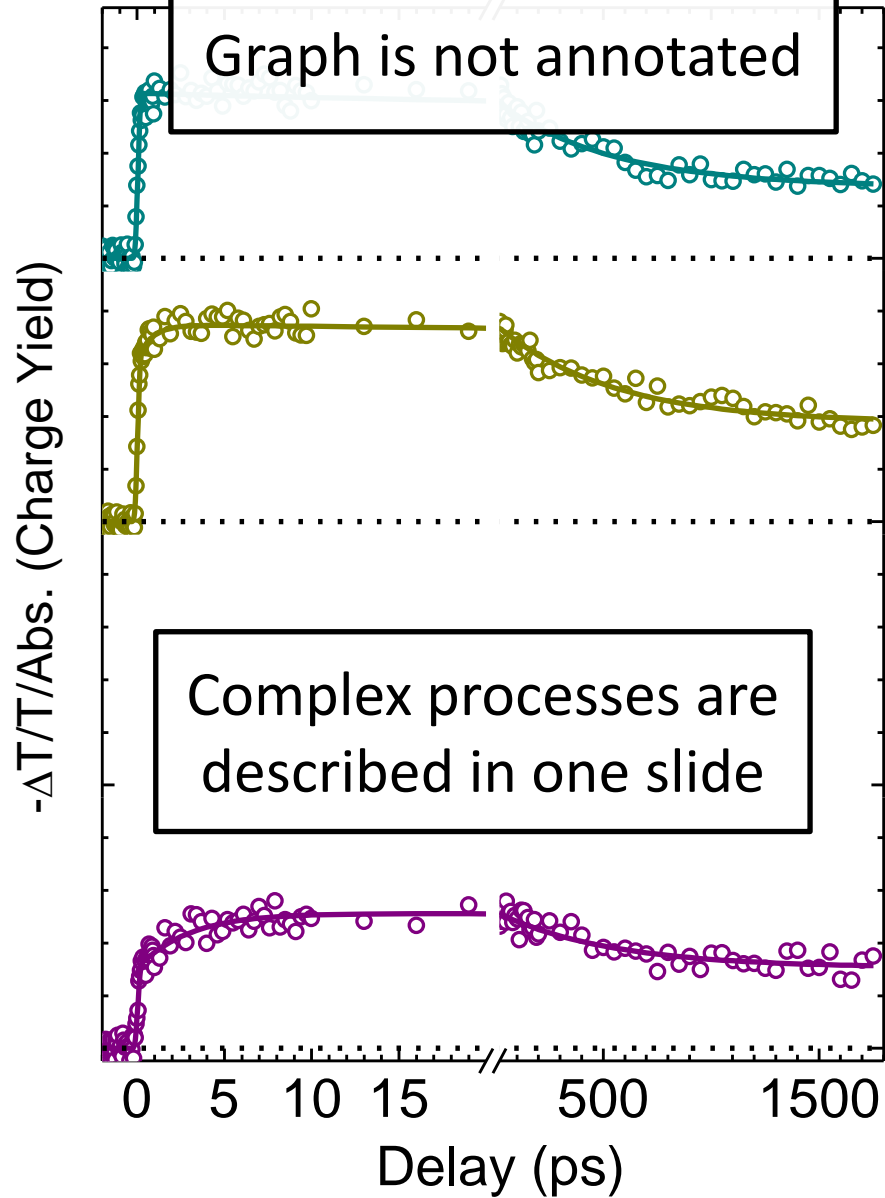


PIA dynamics are complex and consist of:

- Ultrafast charge generation via electron transfer
- Delayed charge generation via hole transfer
- Charge recombination

No slide title

Graph is not annotated



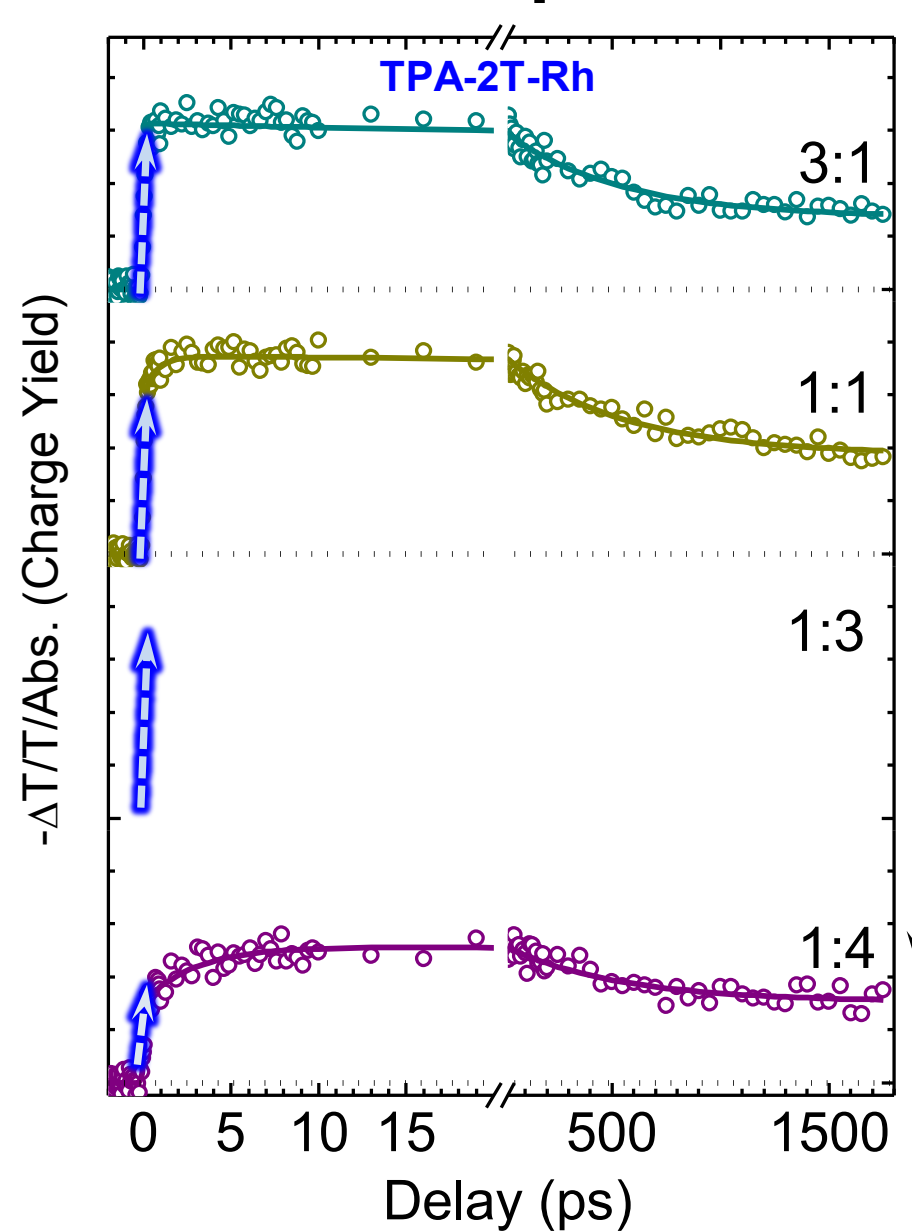
PIA dynamics are complex and consist of:

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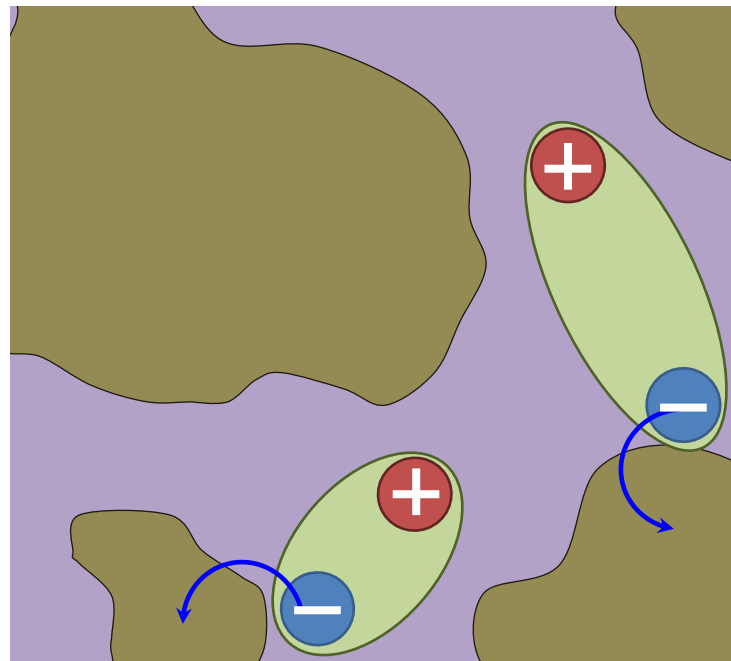
No pictorial illustrations

No slide message

Representative PIA Dynamics



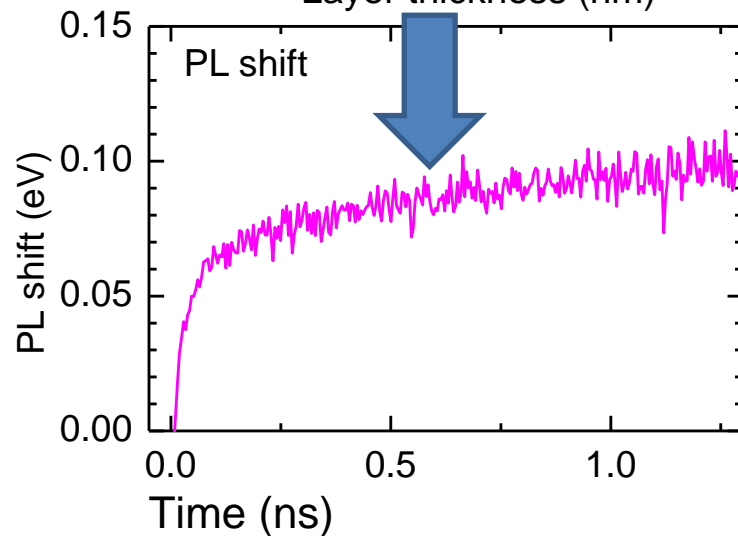
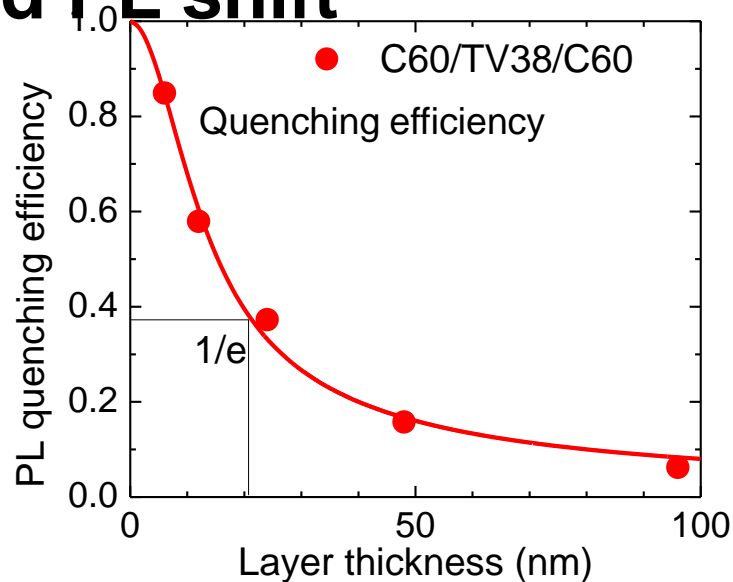
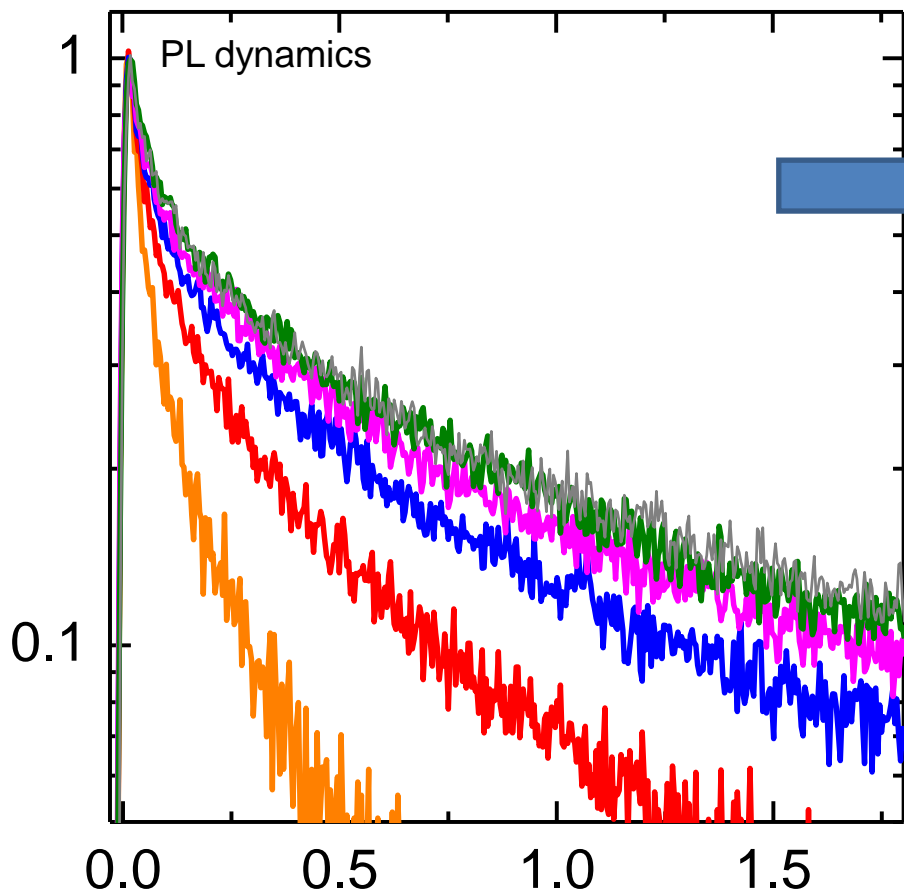
Fast (<200 fs) signal appearance



Exciton splitting via electron transfer process

Corrected version

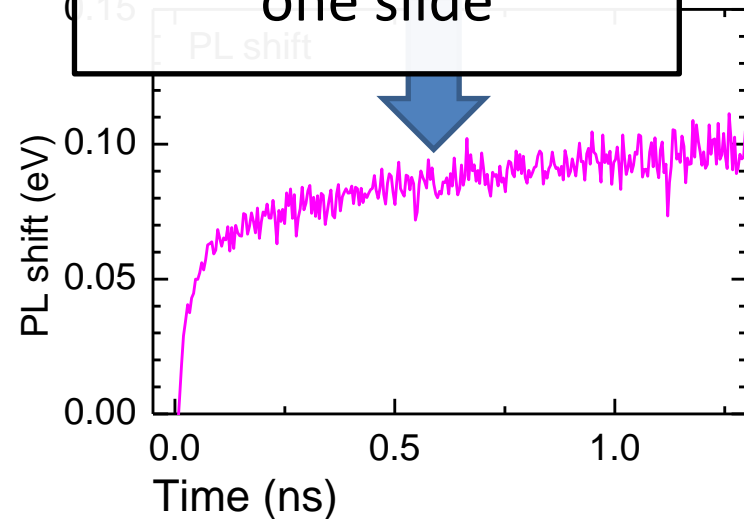
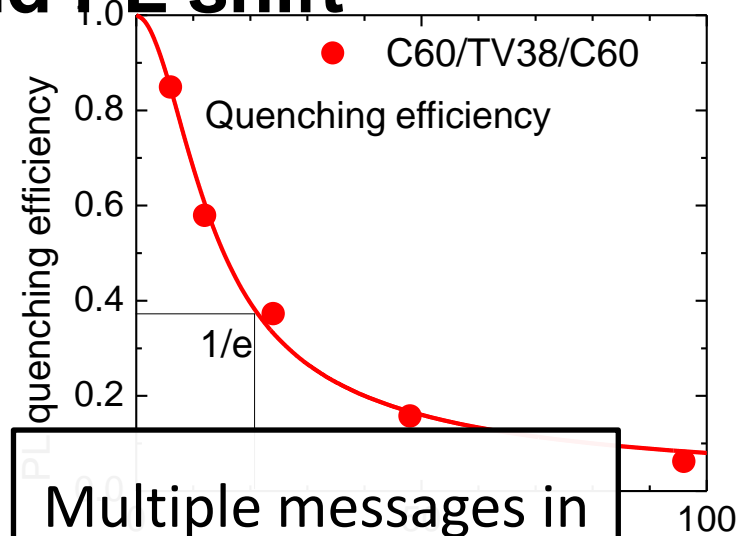
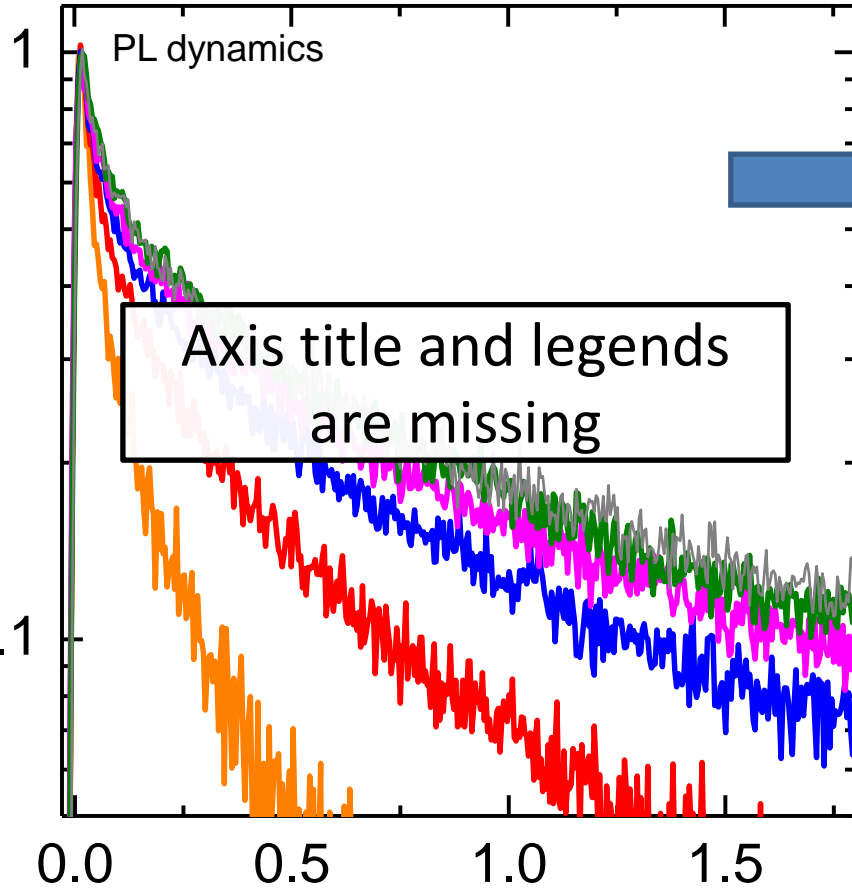
Experimental results for PL dynamics, quenching efficiency and PL shift



PL quenching -> Small diffusion distance (~10 nm) due to the high energy disorder

Experimental results for PL dynamics, quenching efficiency and PL shift

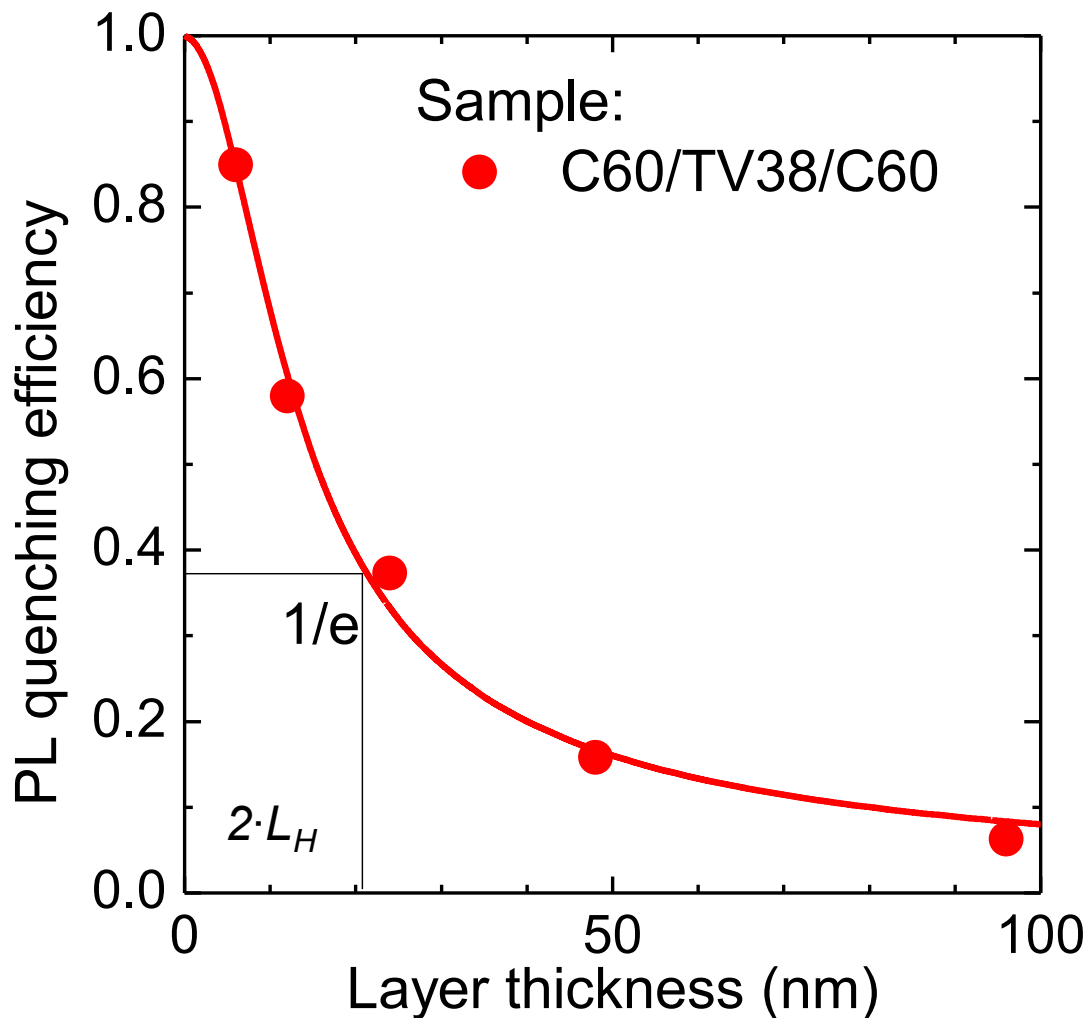
Too long title



Too small font

PL quenching distance (~10 nm) due to the high energy disorder

Exciton Harvesting Distance

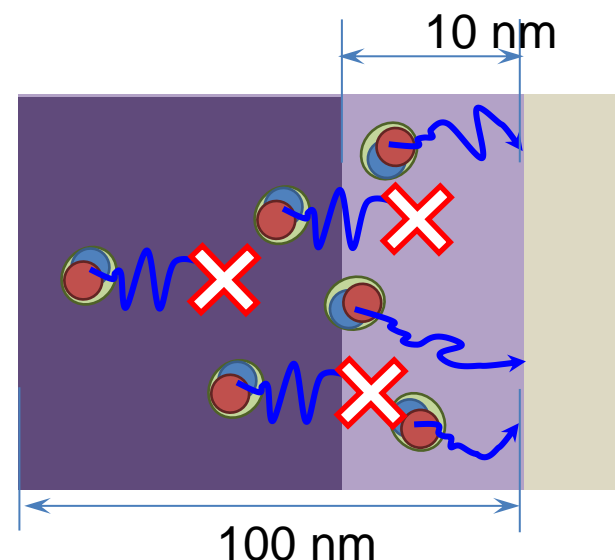


C60/TV38/C60 samples:

Harvesting distance $L_H \sim 10$ nm

vs

Light penetration depth ~ 100 nm



No point in making thick absorbing layers

Typical for disordered solution-processed organic solar cells

Corrected version

Checklist for Slide-Making

- ✓ Create each slide as a single message unit
- ✓ Explicitly state that single message
- ✓ Use simple diagrams to explain concepts
- ✓ Avoid bullet points, opt for word tables
- ✓ Annotate key structures and graphs
- ✓ Highlight steps in multi-step processes
- ✓ Use animations for complex slides
- ✓ Use pictorial illustrations
- ✓ Use readable fonts
- ✓ Keep the background in the background

