The role of multiphoton excitation in ultrafast white-light continuum generation

André Brodeur
Chris B. Schaffer
Eric Mazur

APS Centennial Meeting
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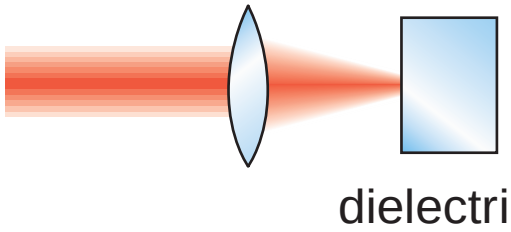
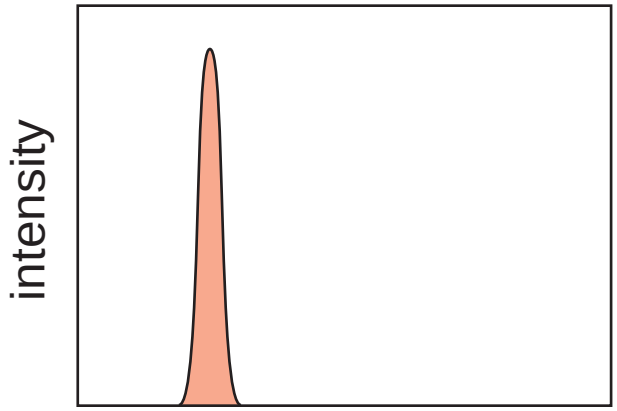
Continuum generation

high-power femtosecond laser pulse…

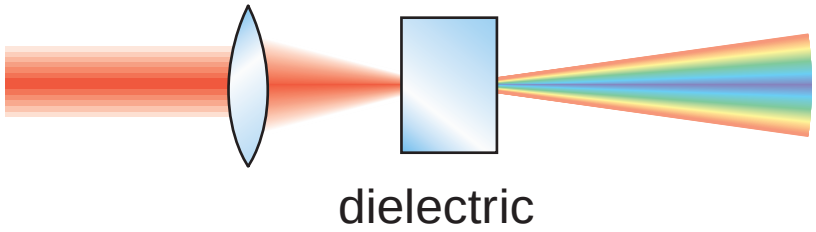


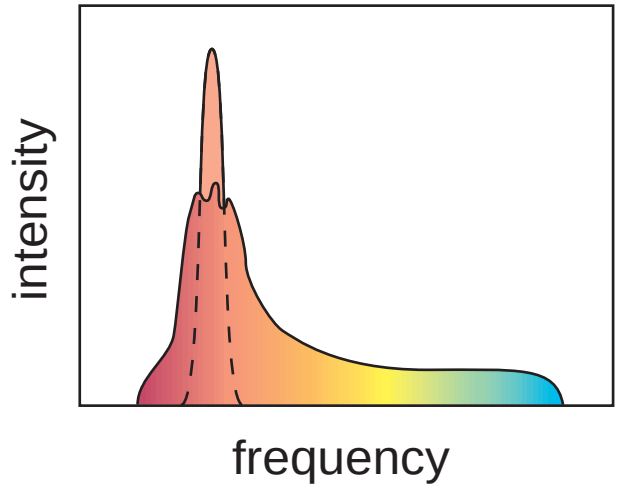
dielectric



Continuum generation

…produces broad continuum





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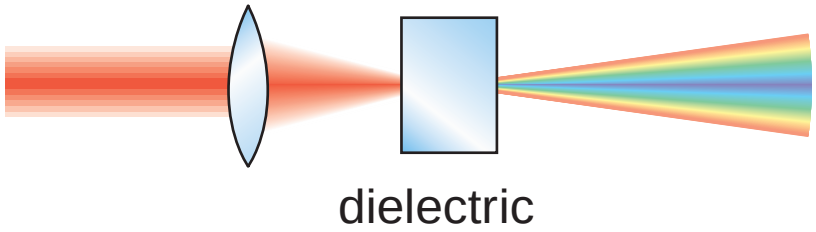
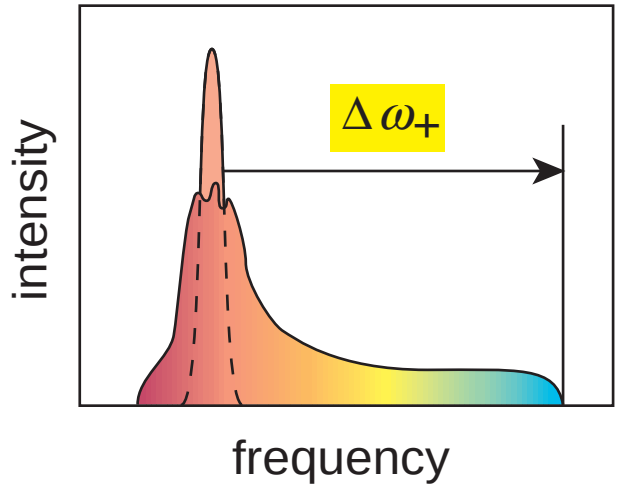
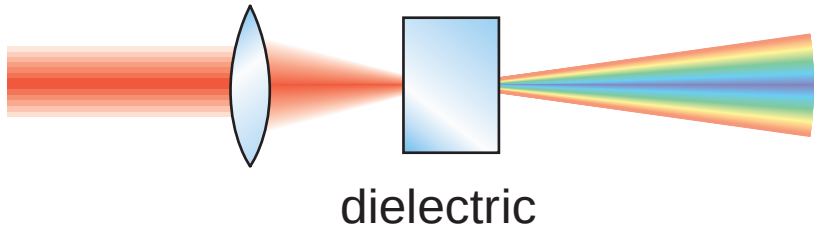
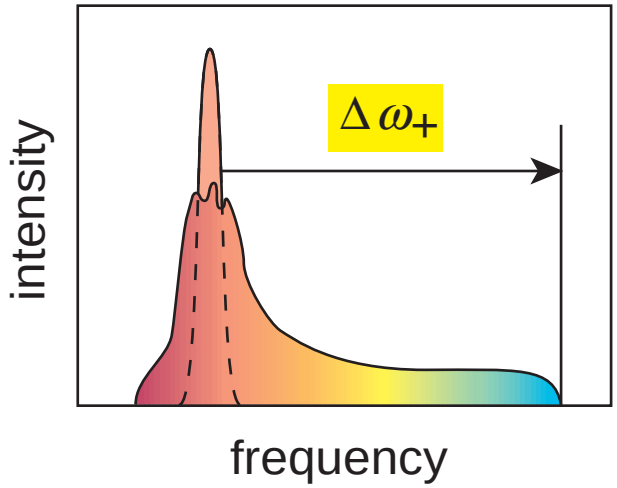




Continuum generation

How does $\Delta\omega_+$ vary with laser frequency and material?





Outline

- **Broadening mechanisms**
- **Frequency and material dependence**
- **Comparison with models**

Broadening mechanisms

self-phase modulation: $n = n_o + n_2 I$

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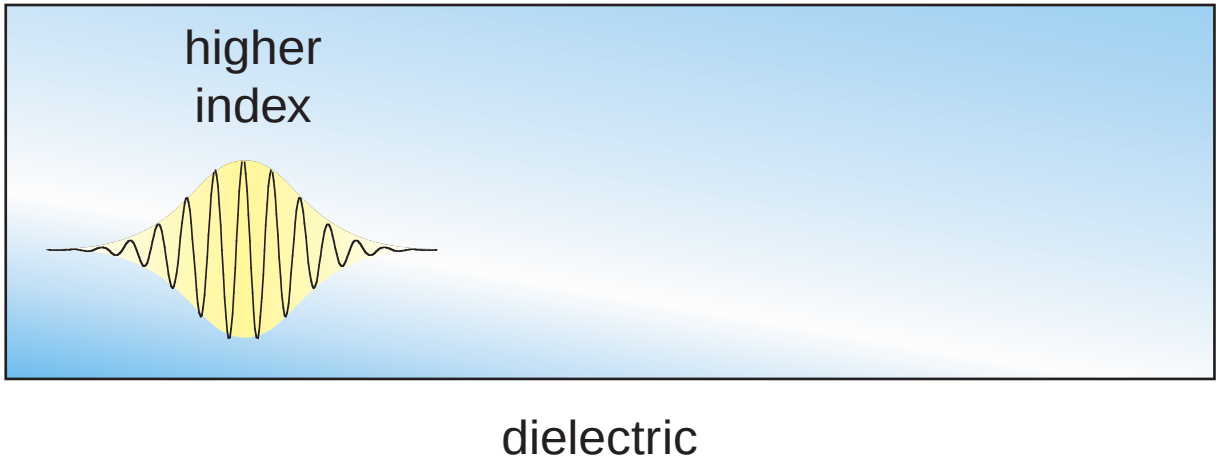

Broadening mechanisms

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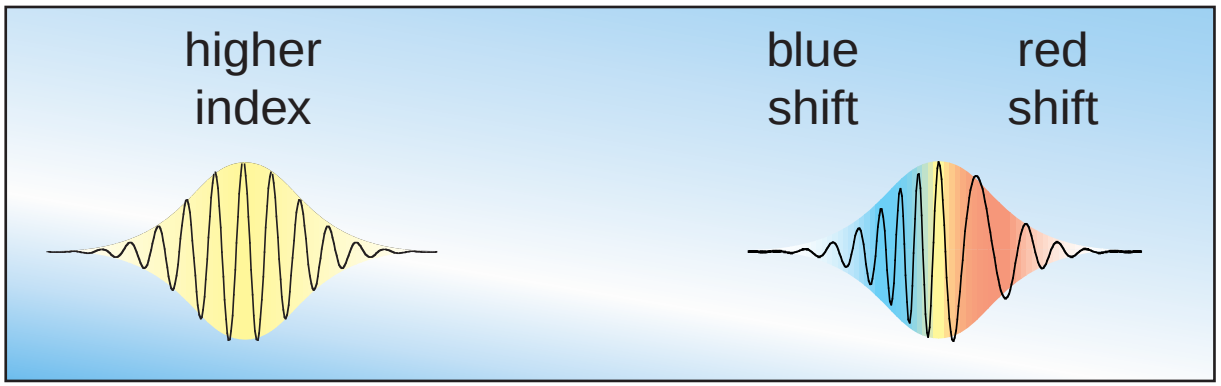

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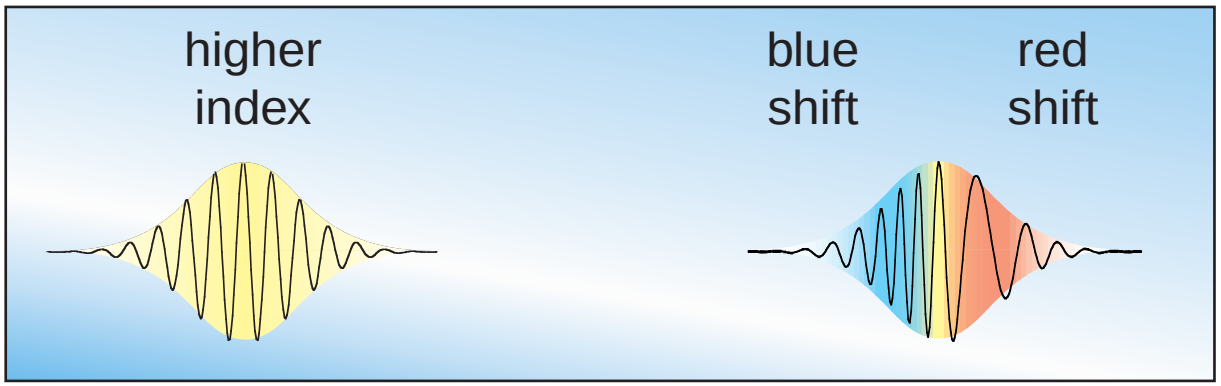
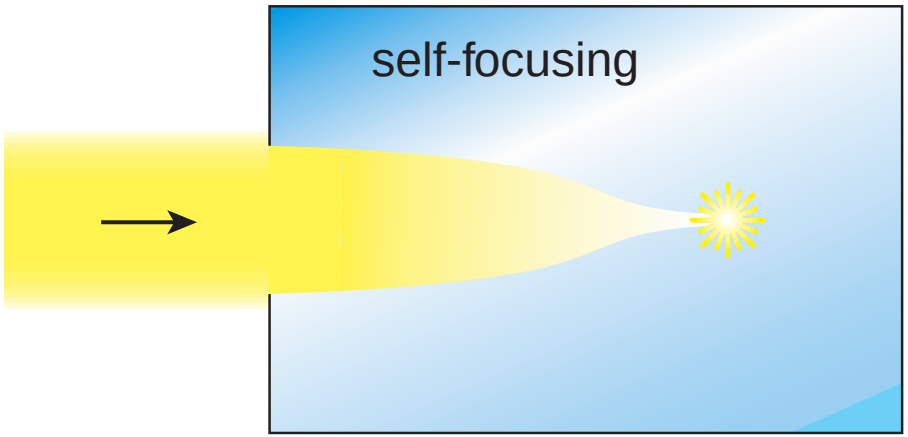


$\Delta\omega_+$ increases with intensity…

Broadening mechanisms

… but what is the intensity at the focus?



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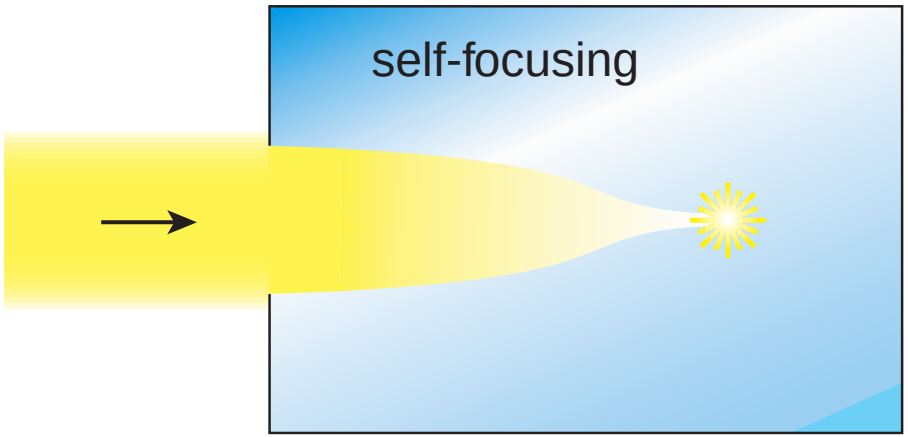
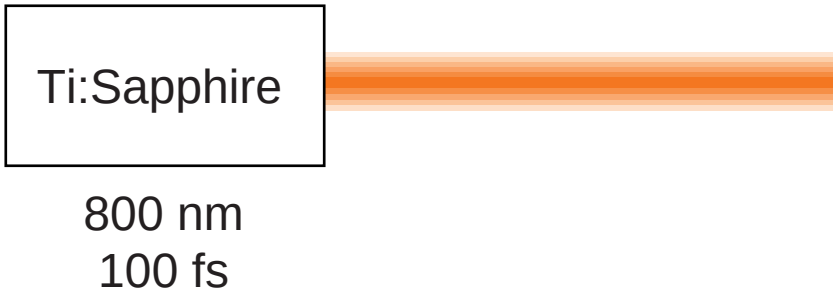


Is intensity limited by ionization, or by group velocity dispersion?

Frequency and material dependence

Measure $\Delta\omega_+$



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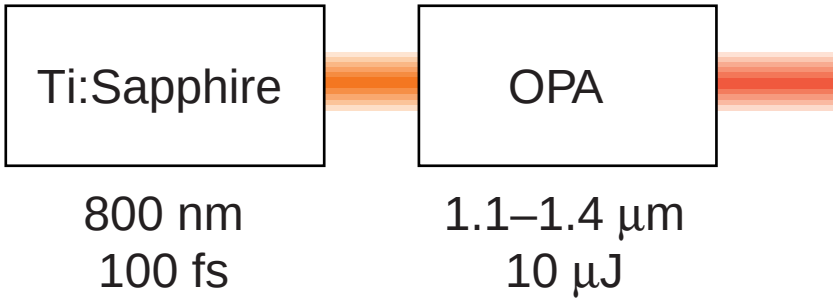

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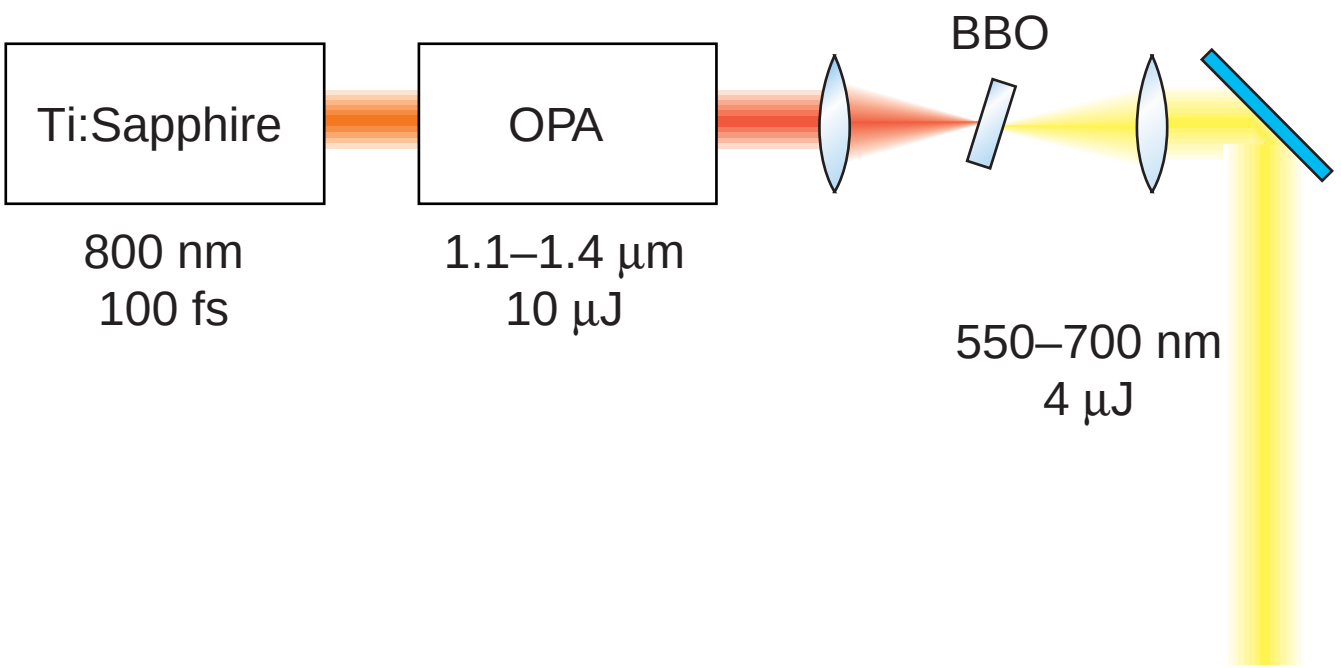

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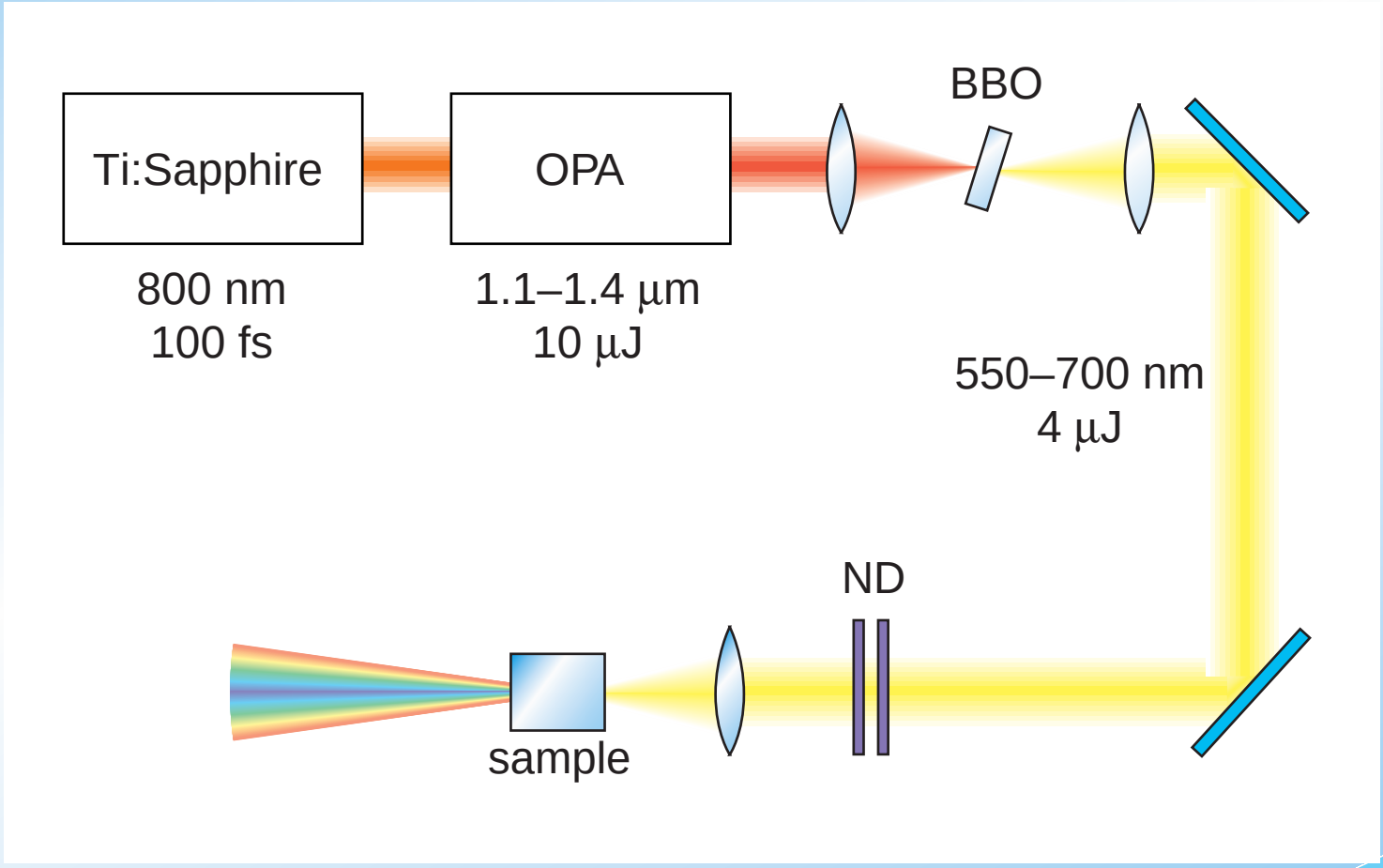

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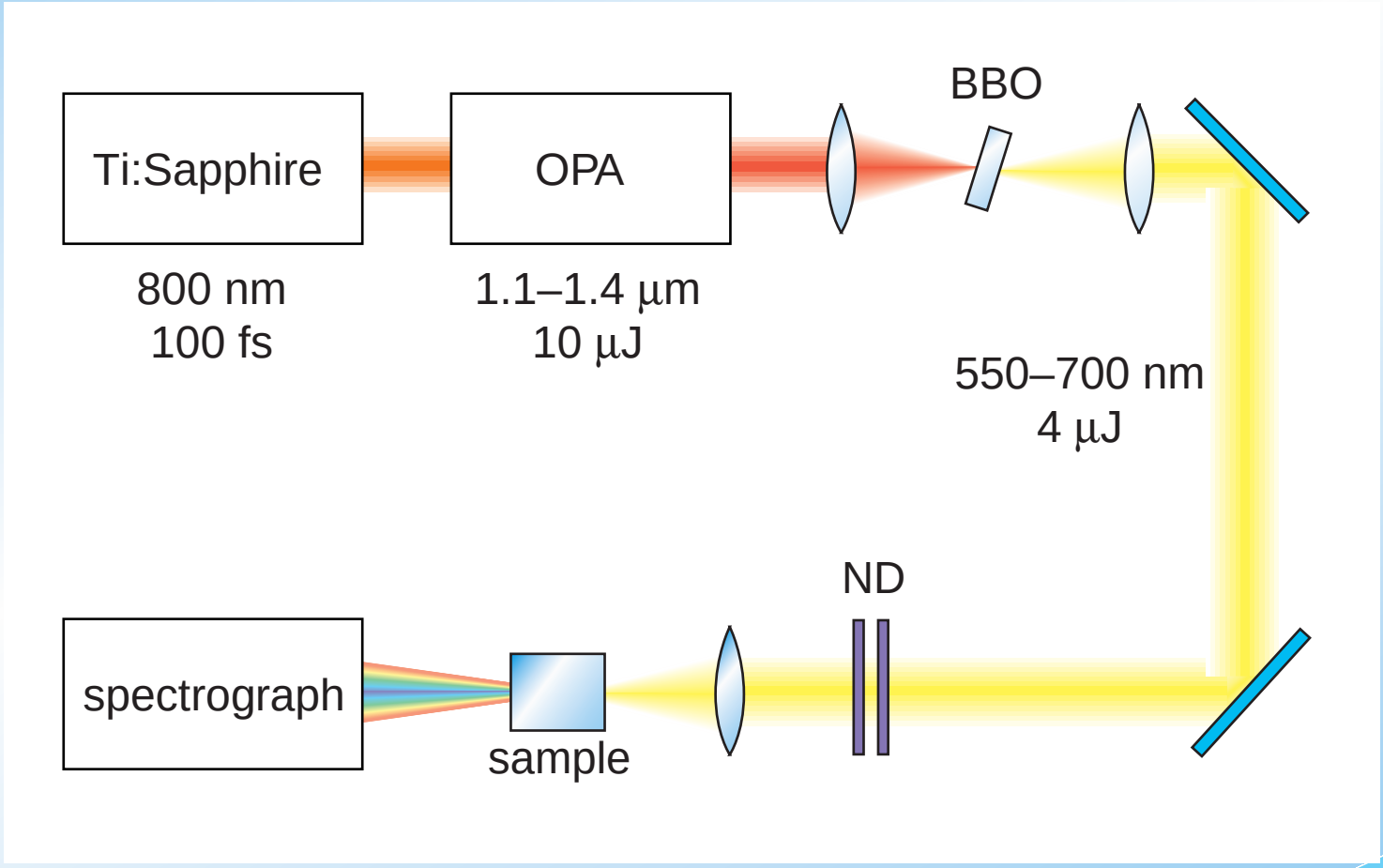

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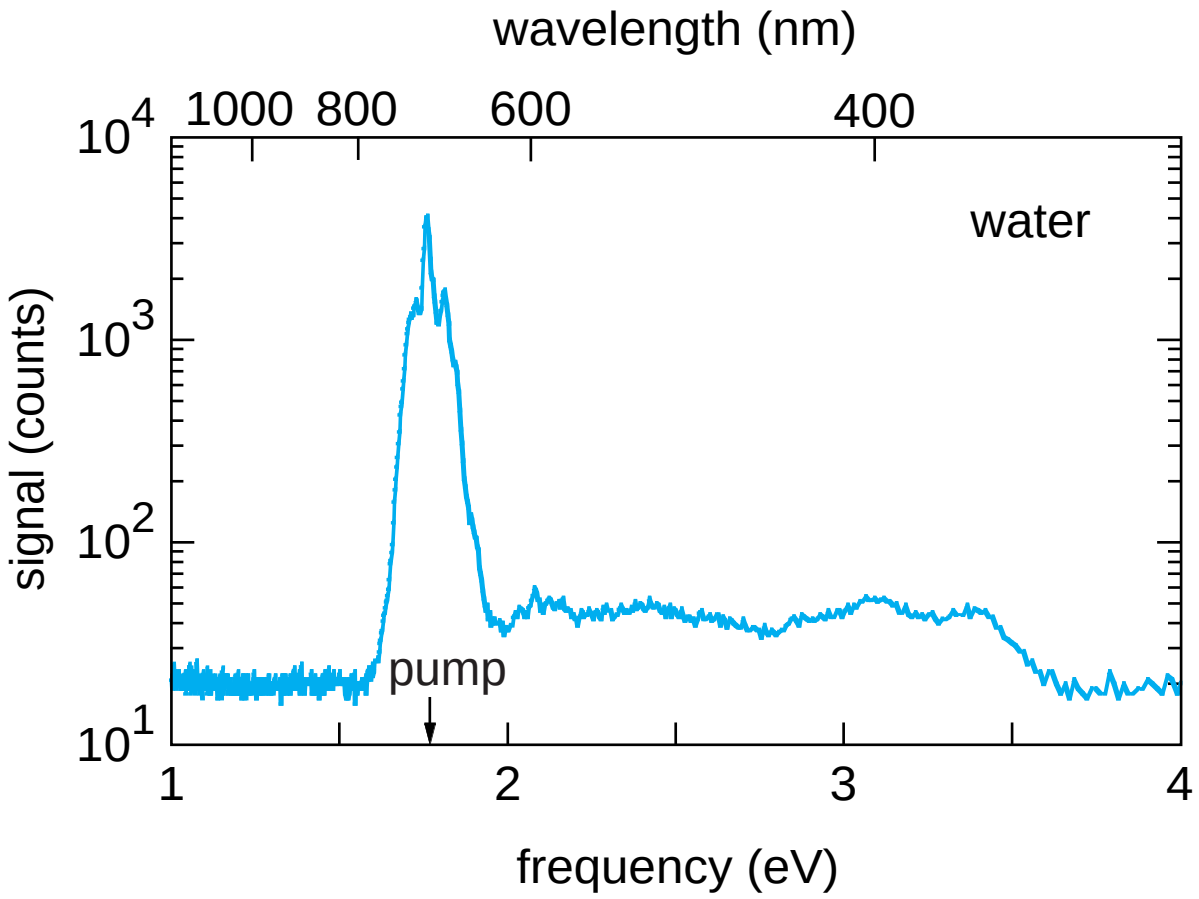

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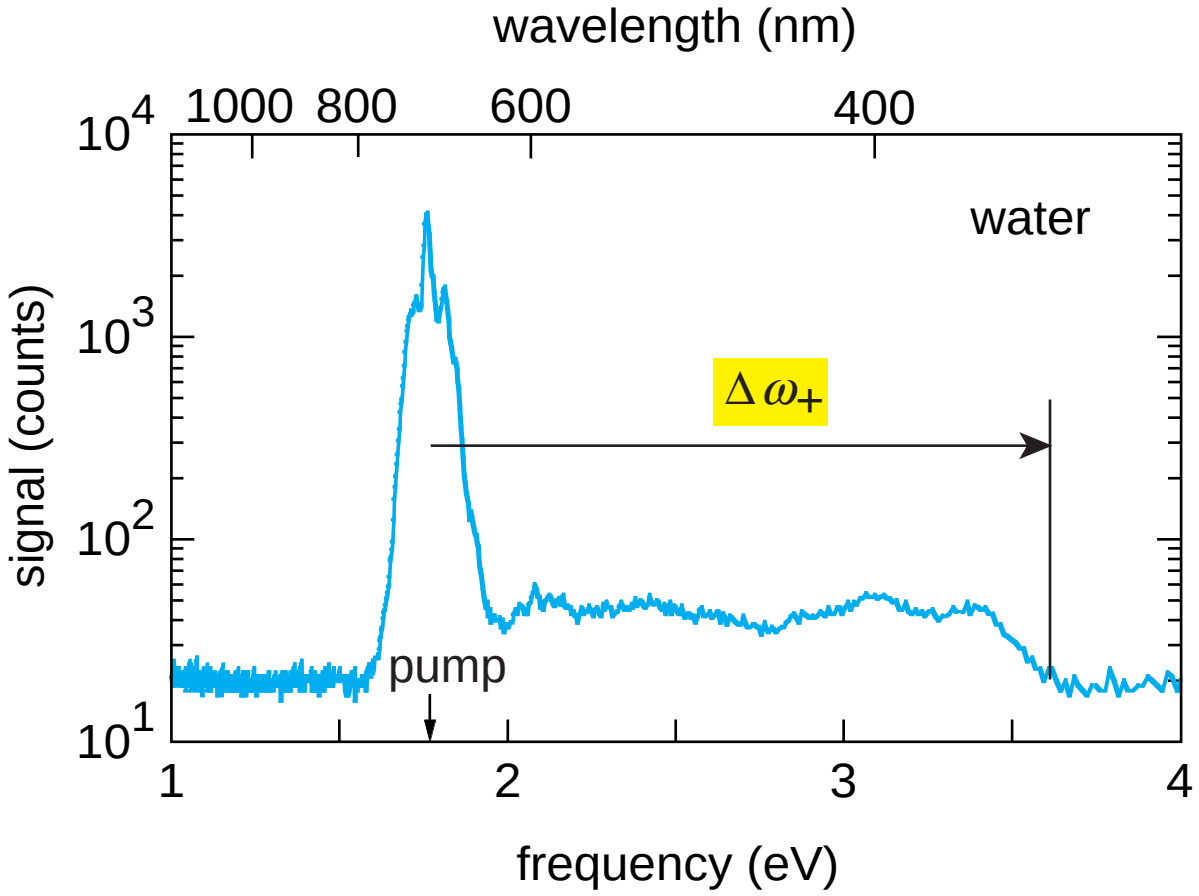
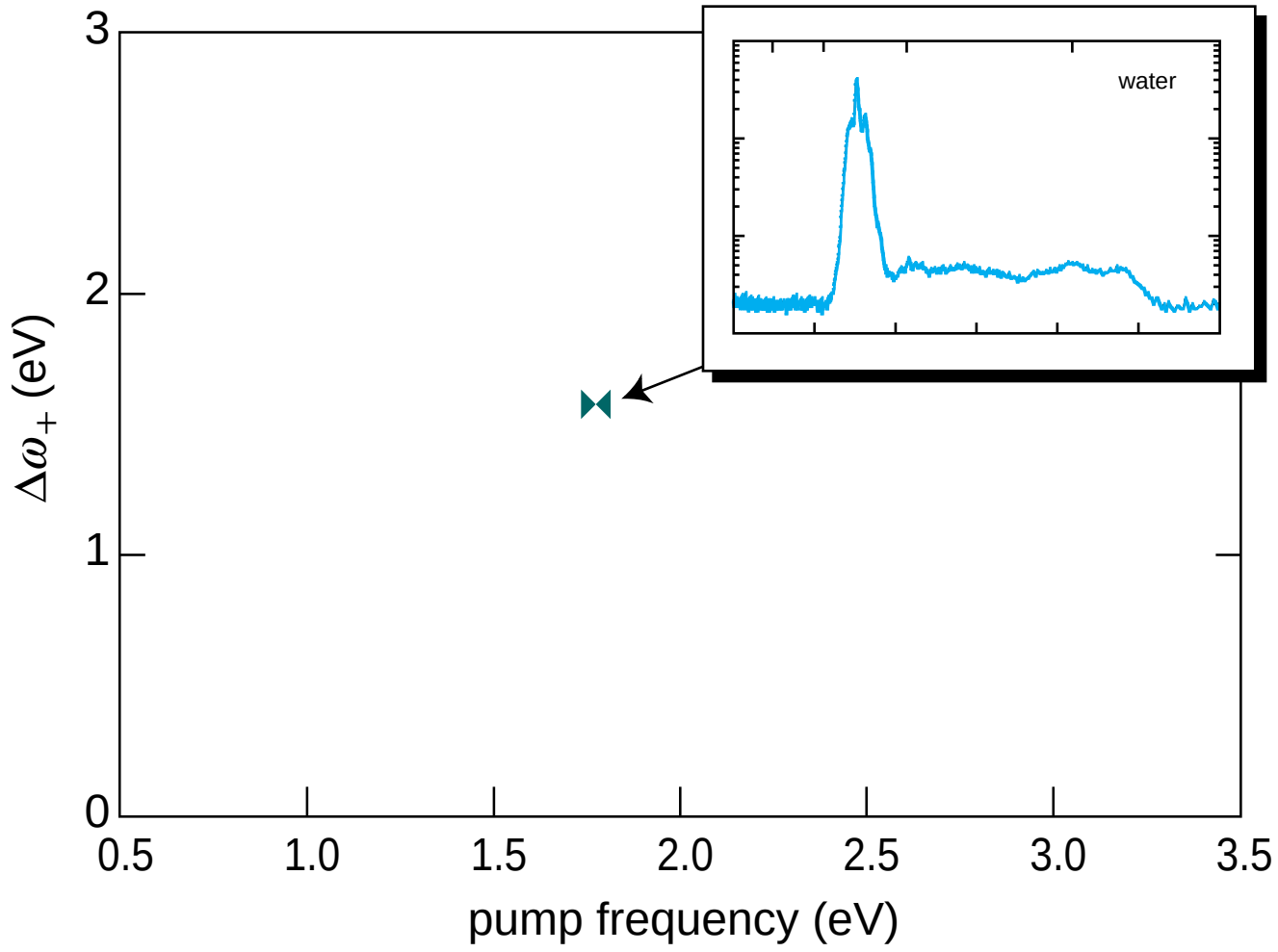


Frequency and material dependence

dependence on pump frequency



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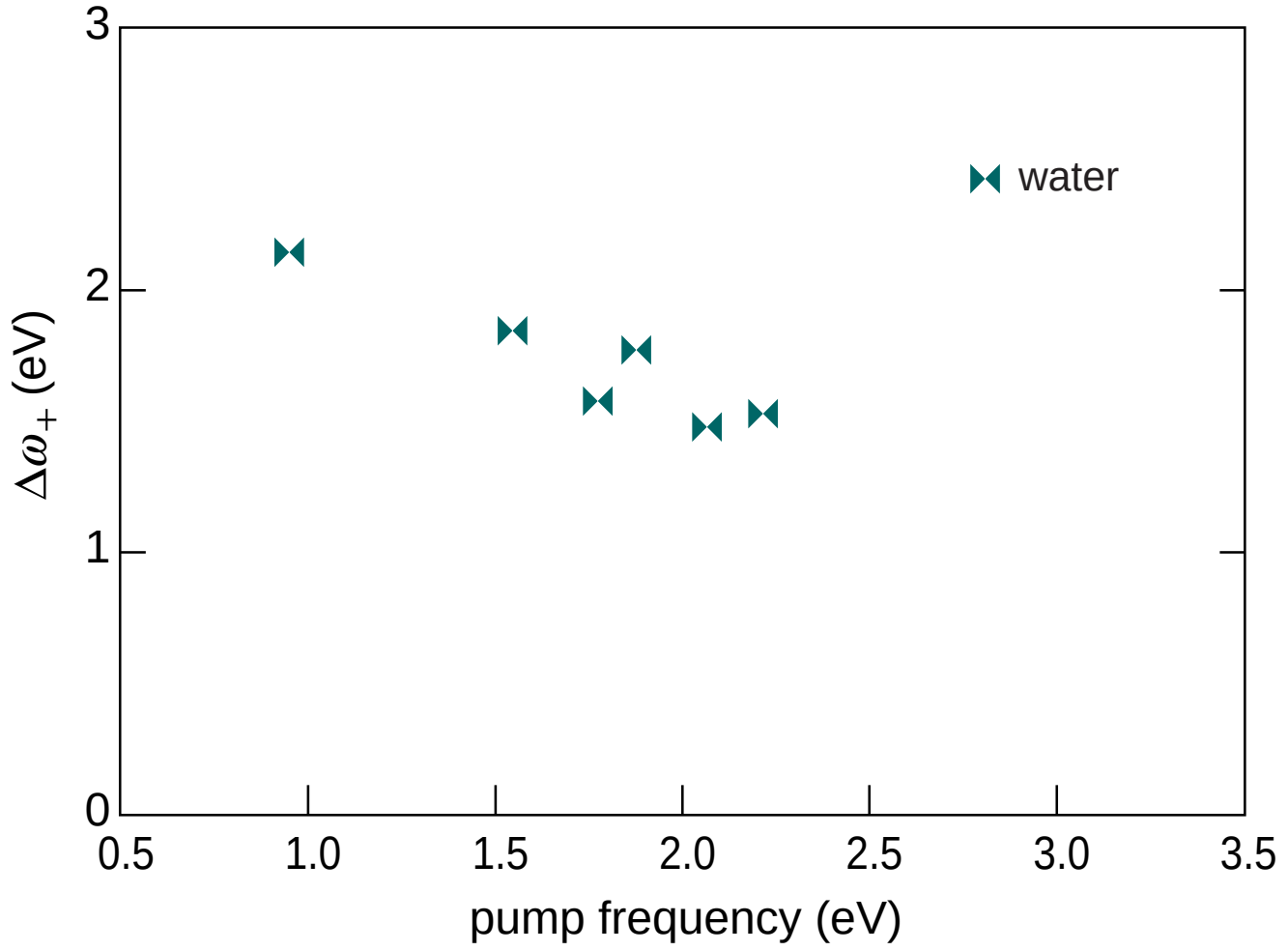

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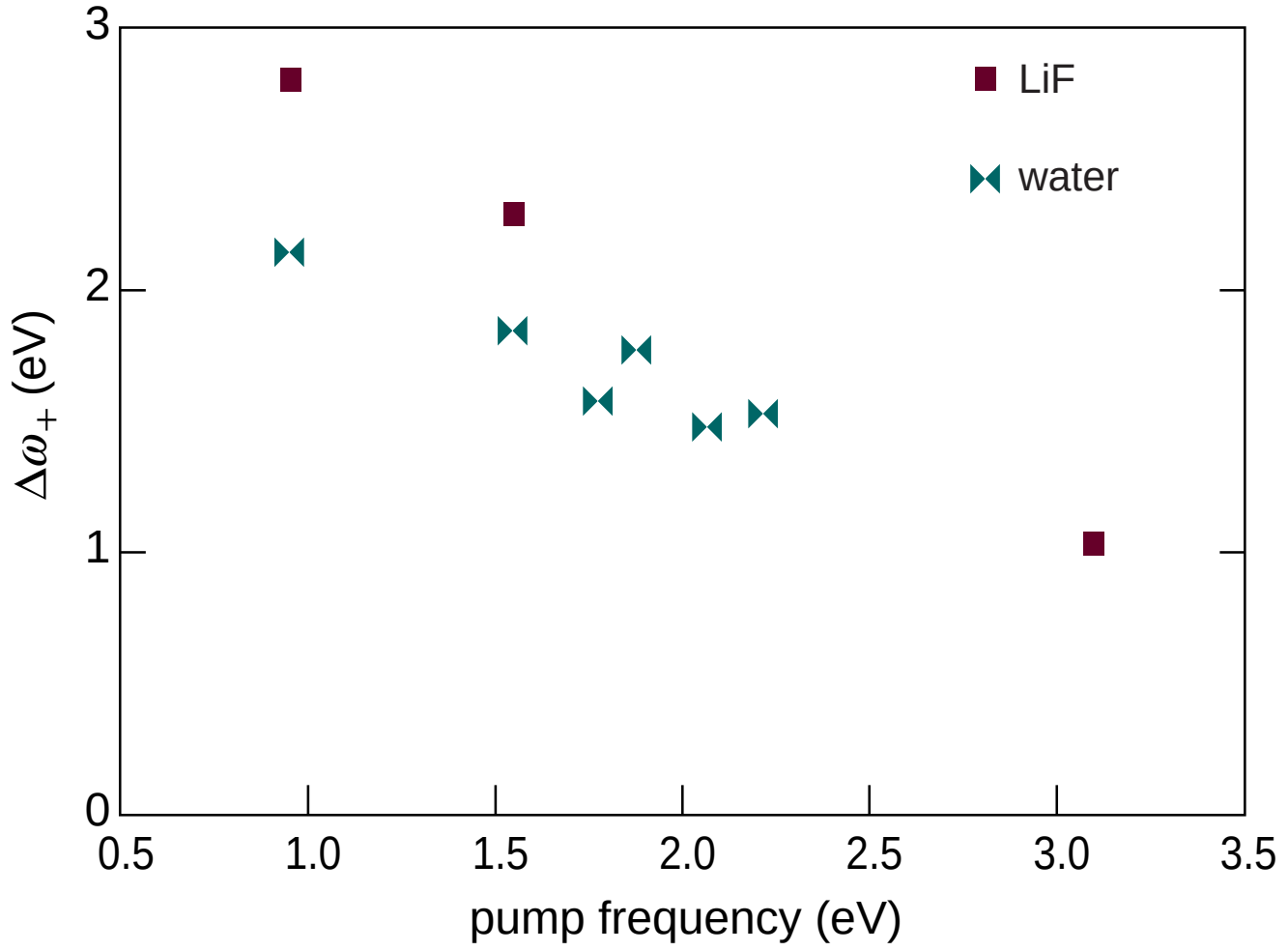

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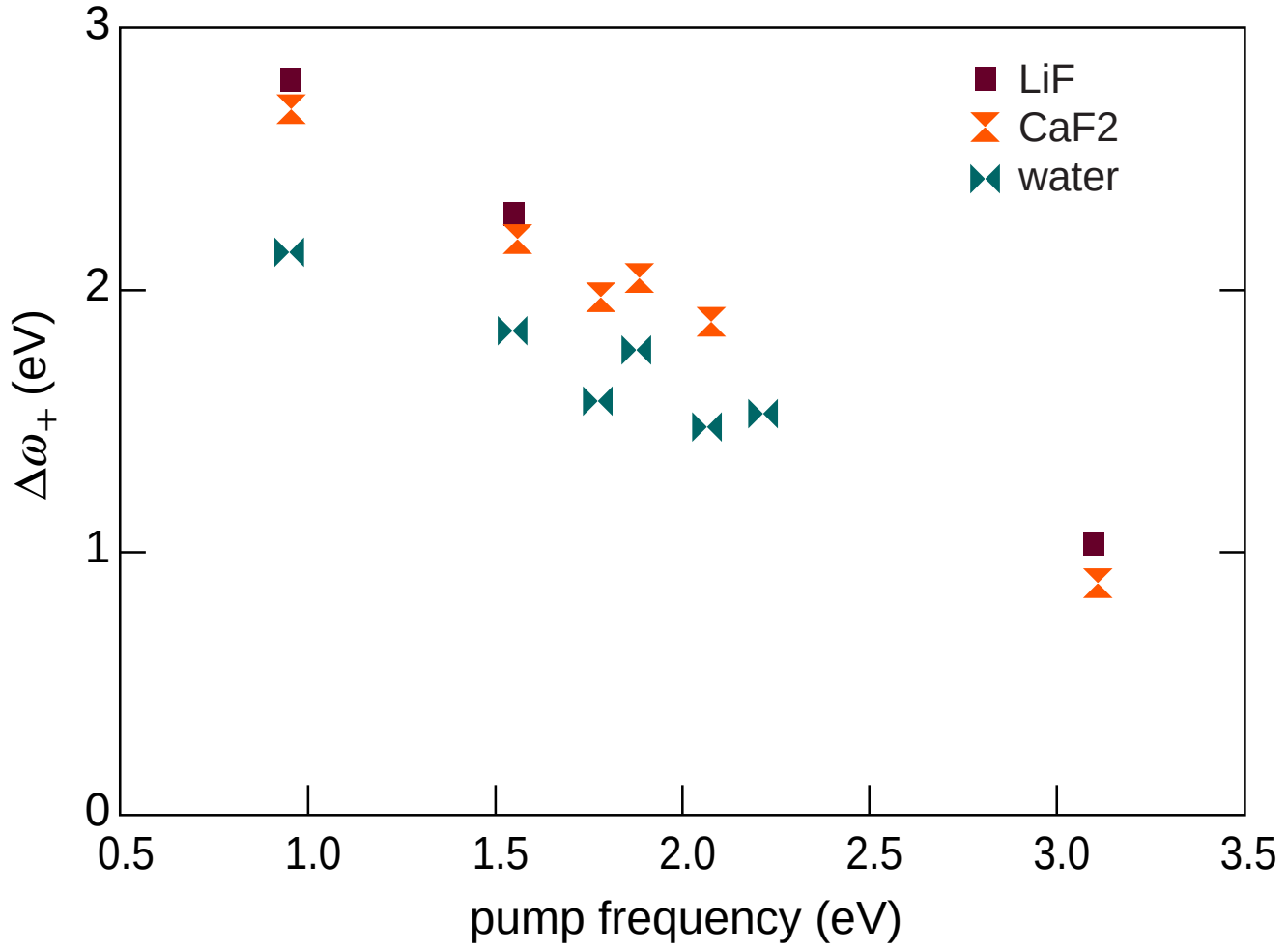

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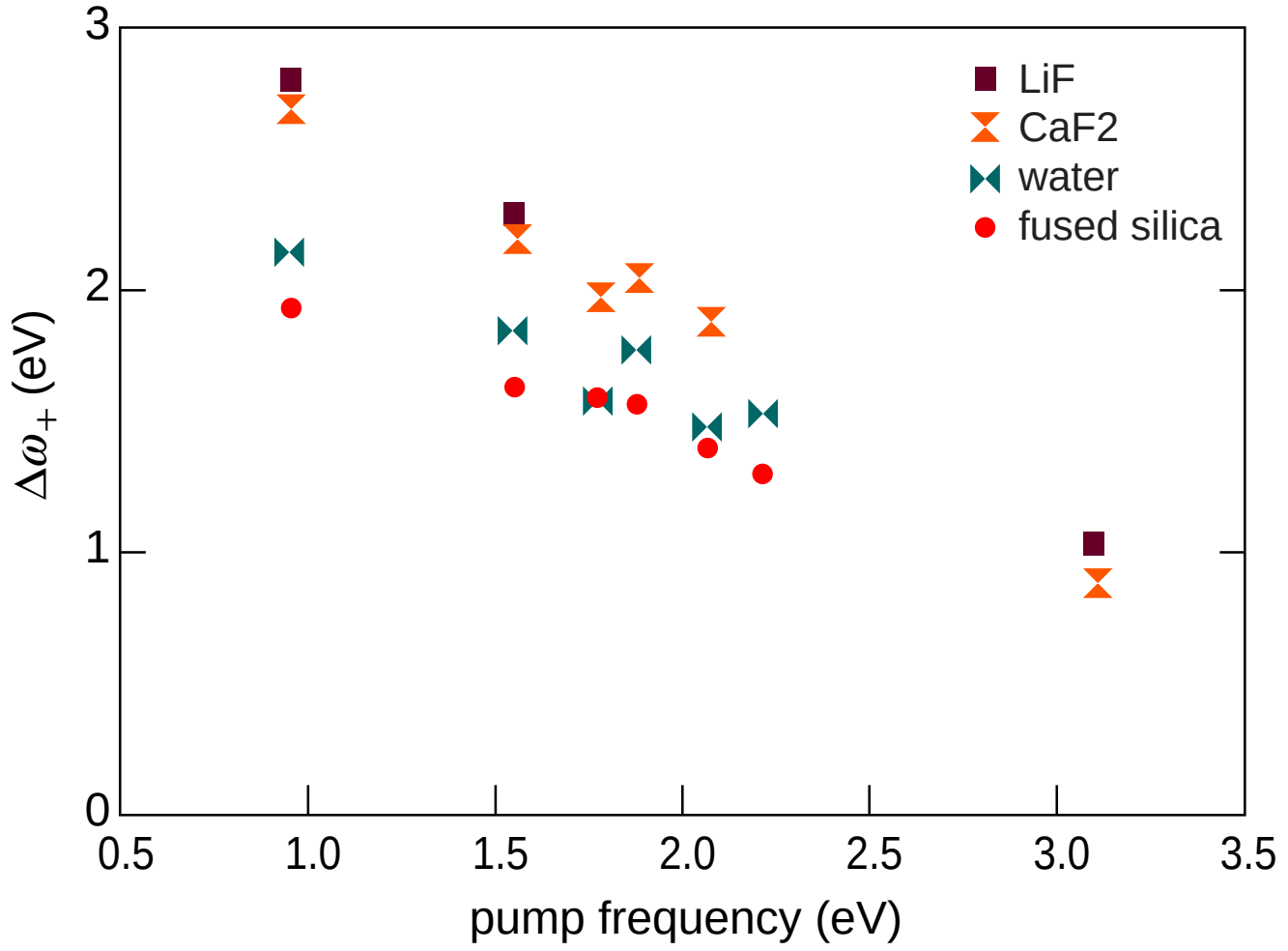

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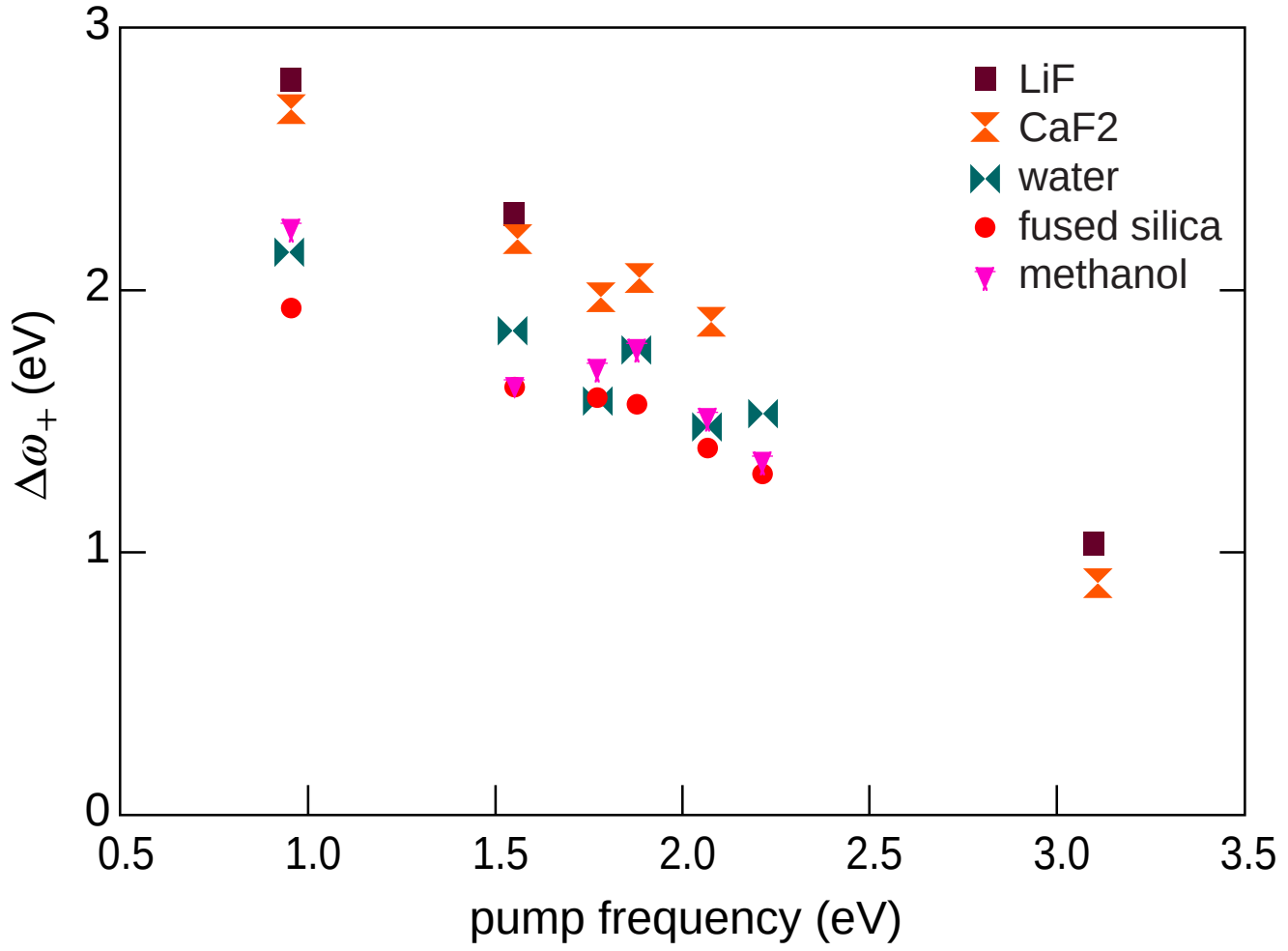

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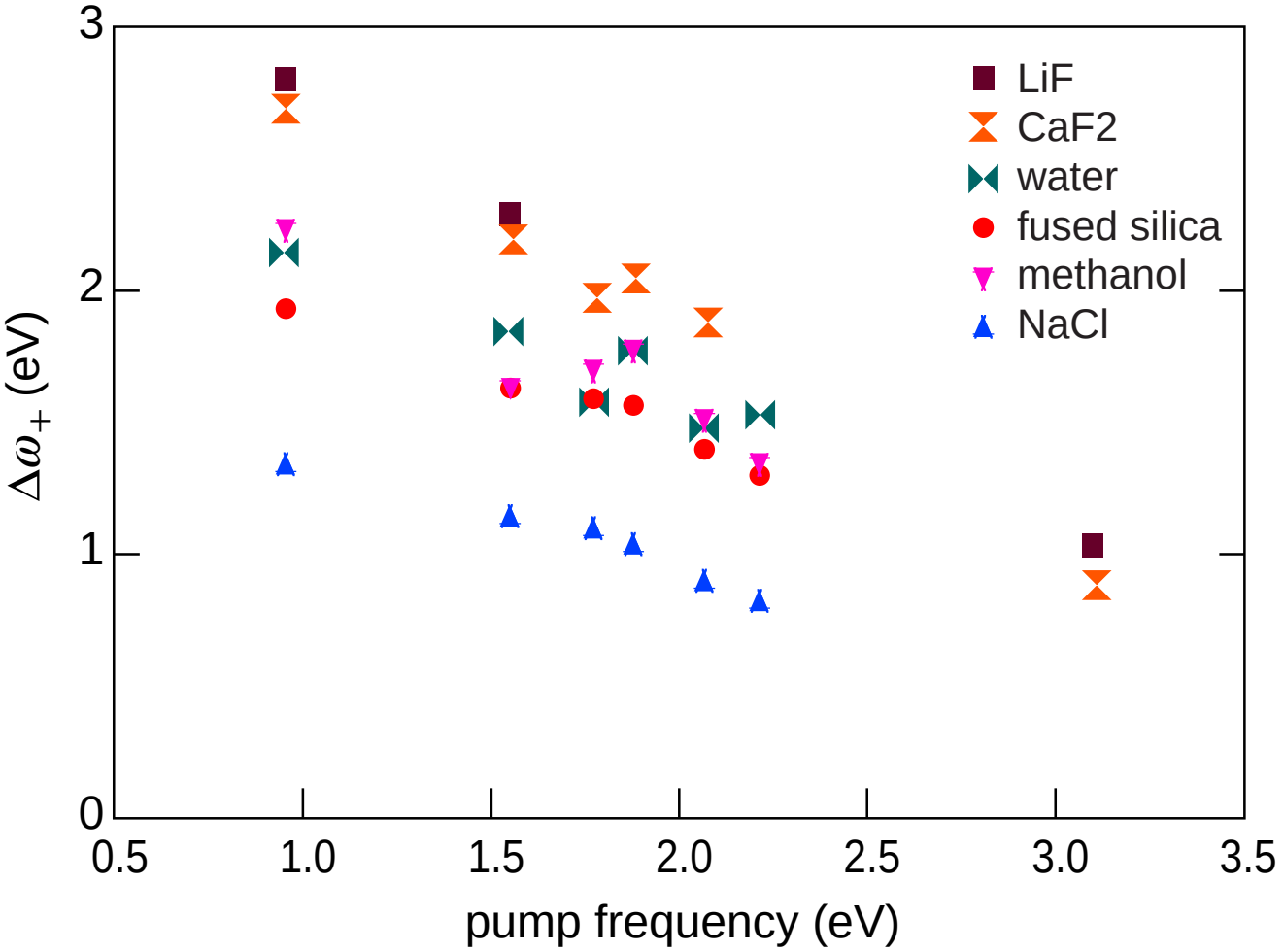

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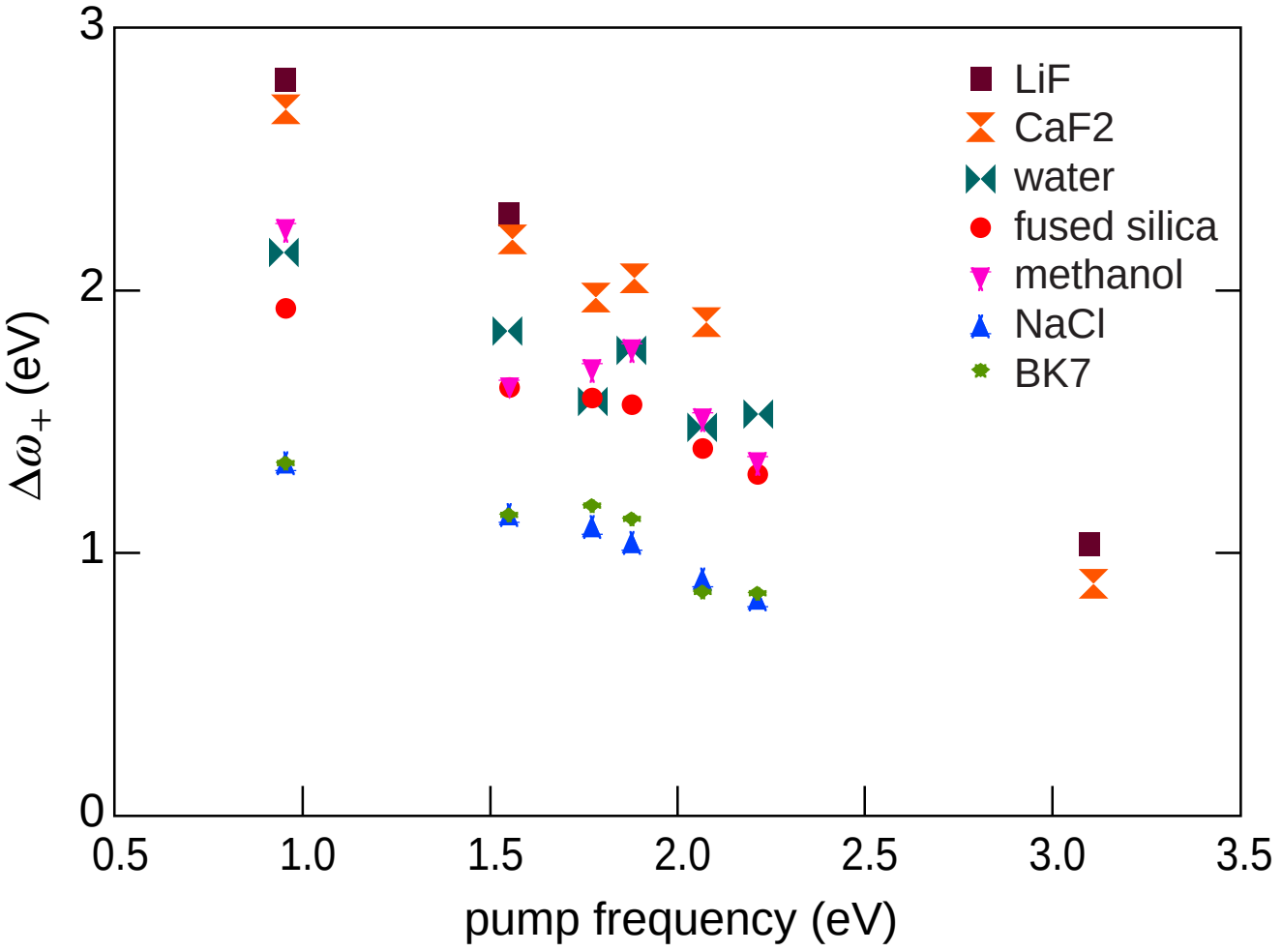

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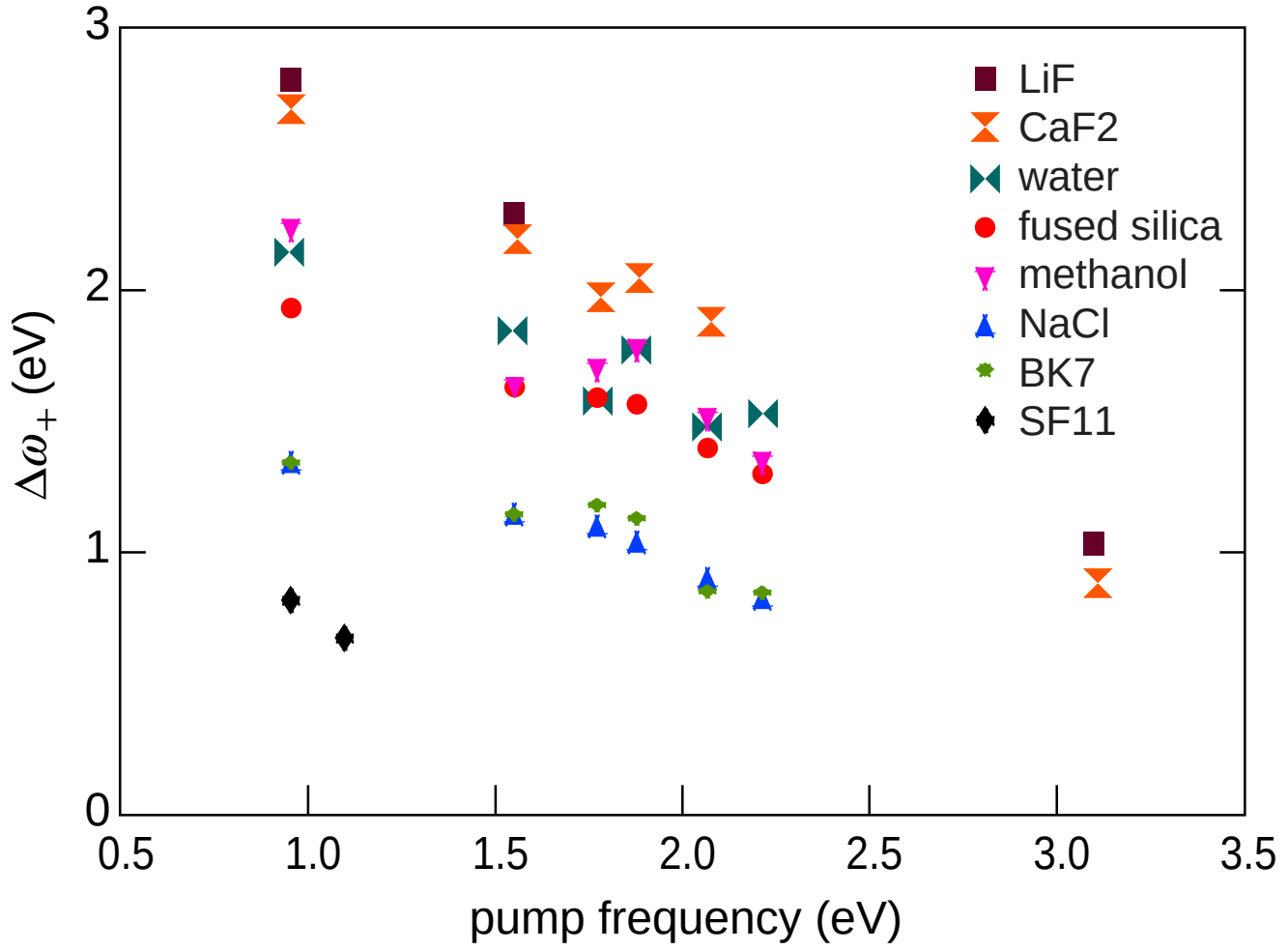

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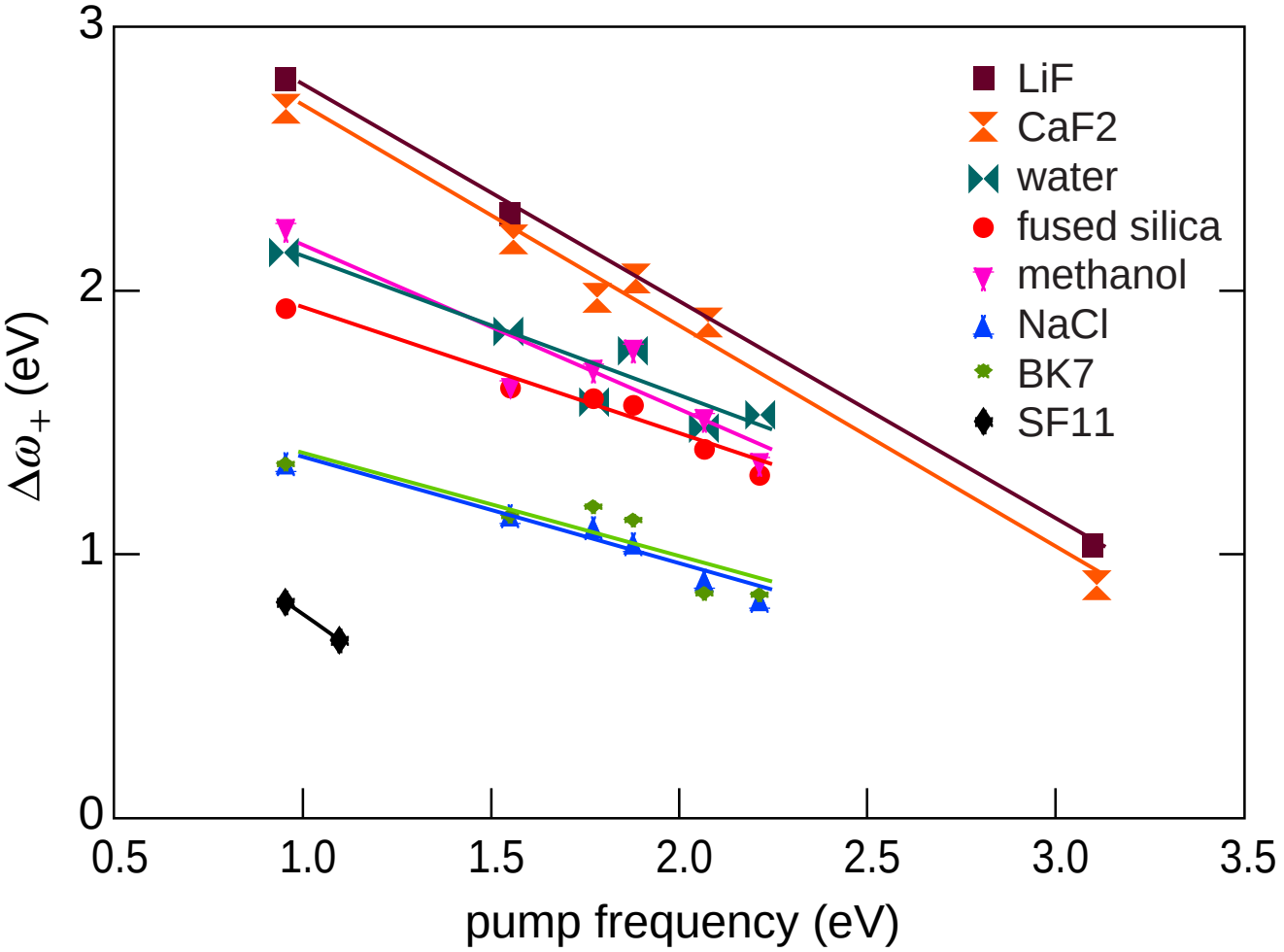

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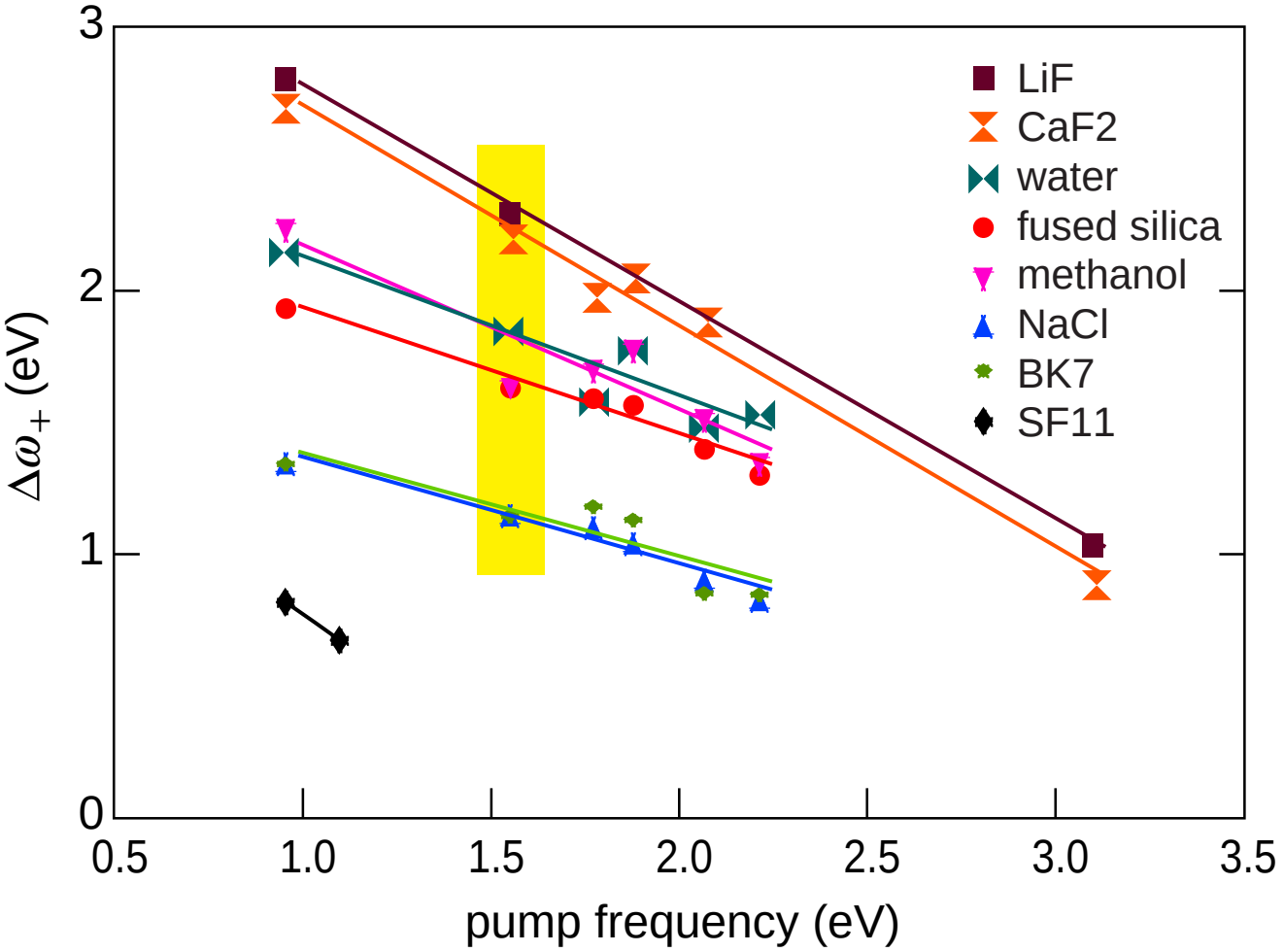
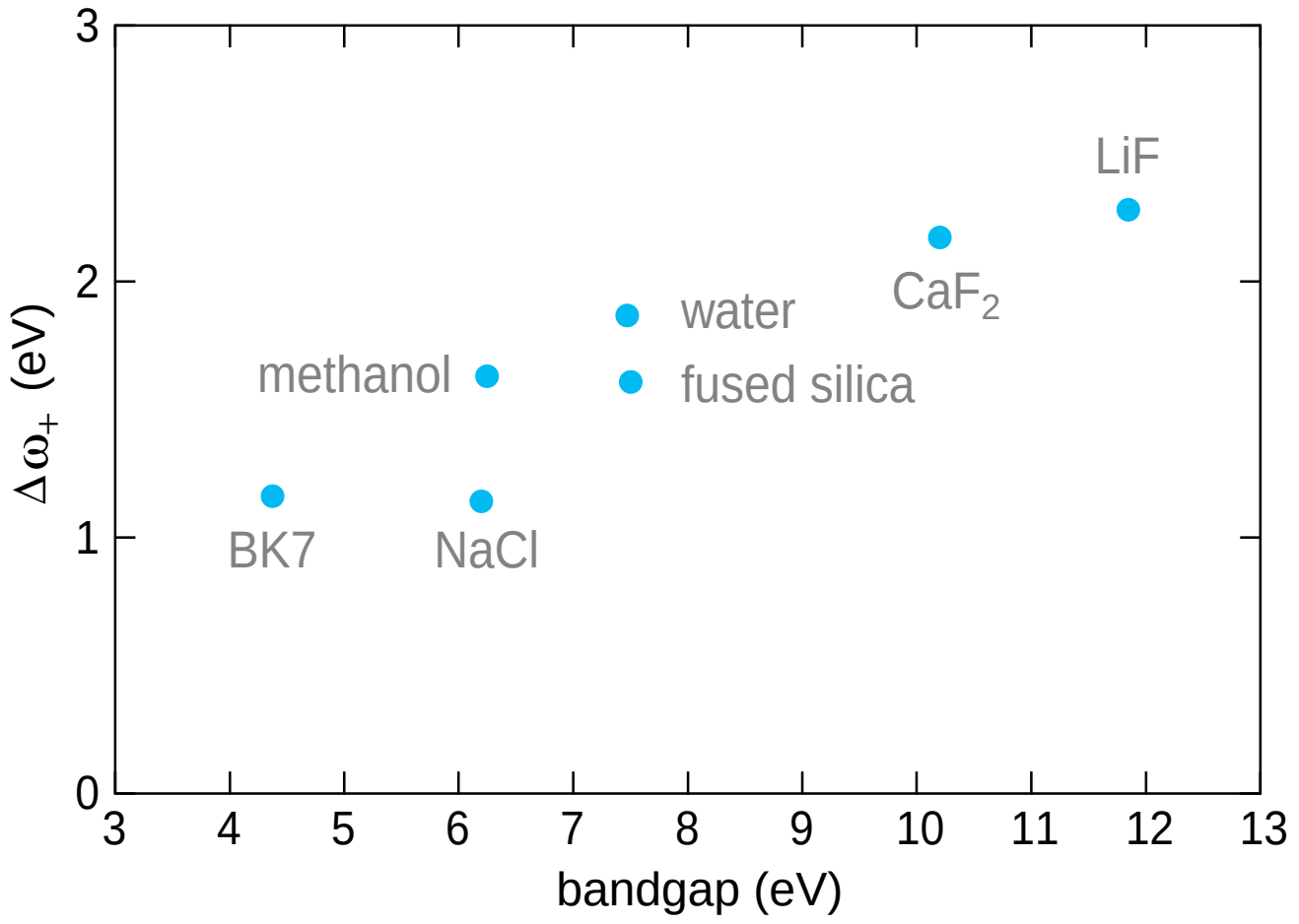


Frequency and material dependence

dependence on bandgap

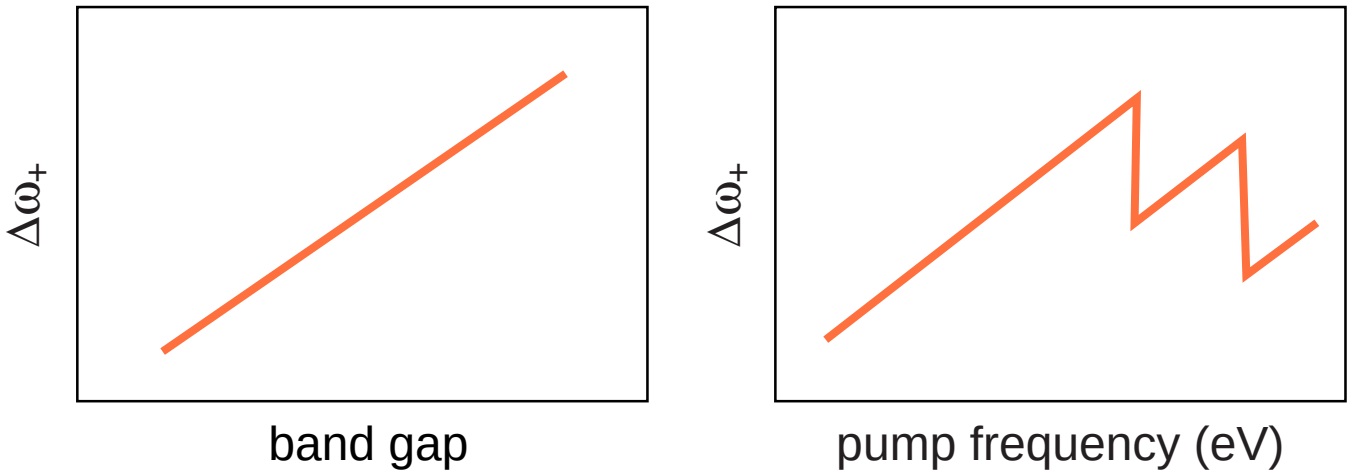


Frequency and material dependence

- $\Delta\omega_+$ **increases with bandgap**
- $\Delta\omega_+$ **decreases with pump frequency**

Comparison with models

1. ionization limits intensity at focus



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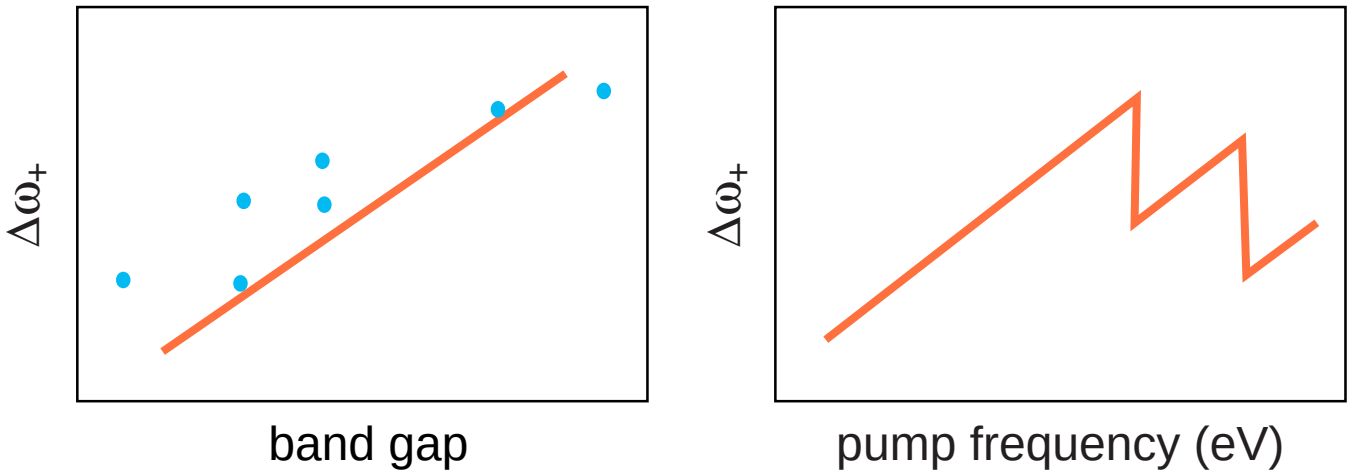

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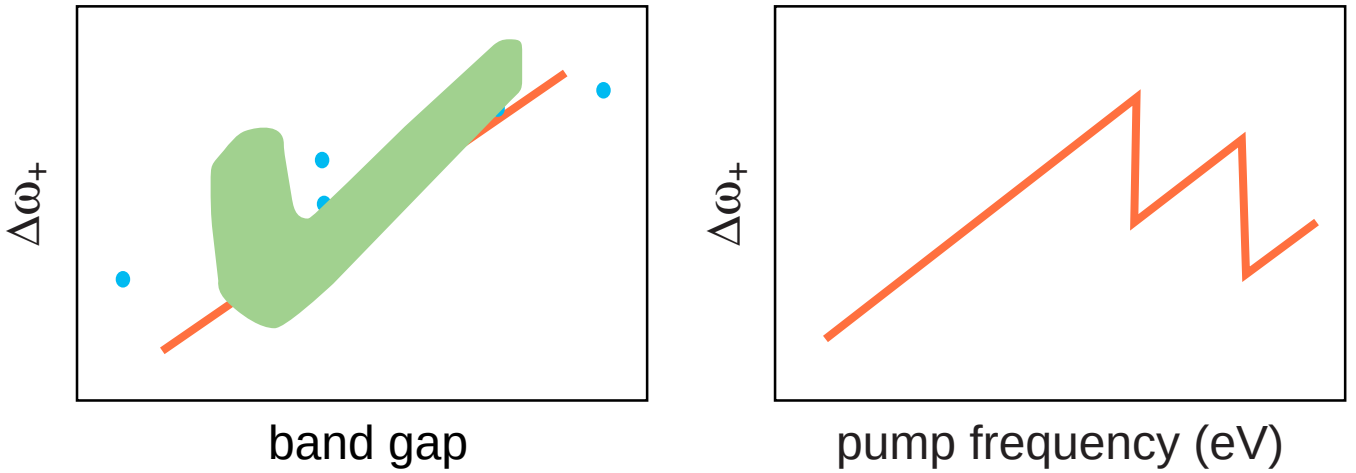

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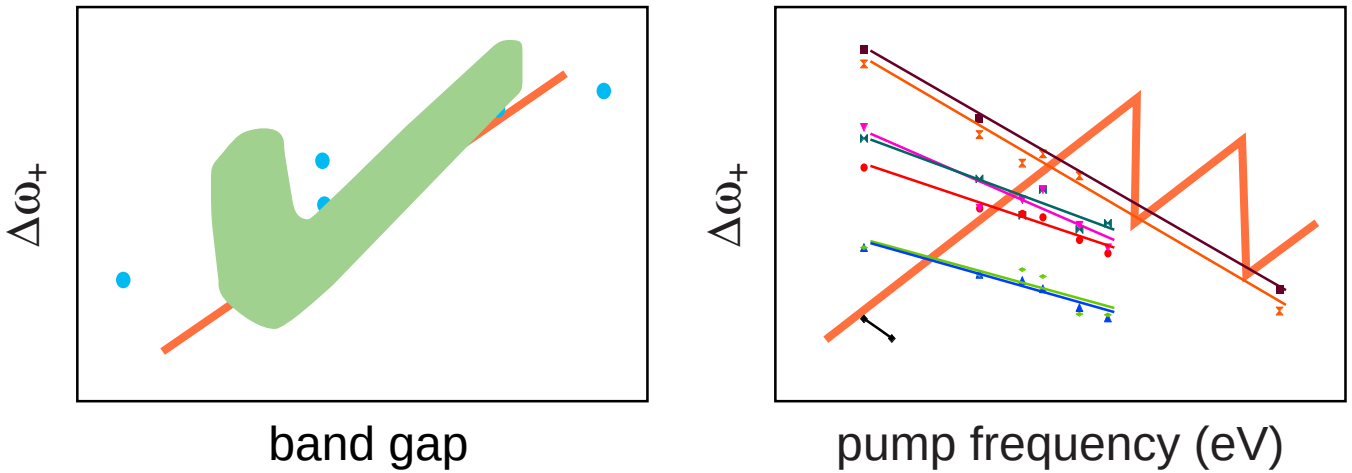

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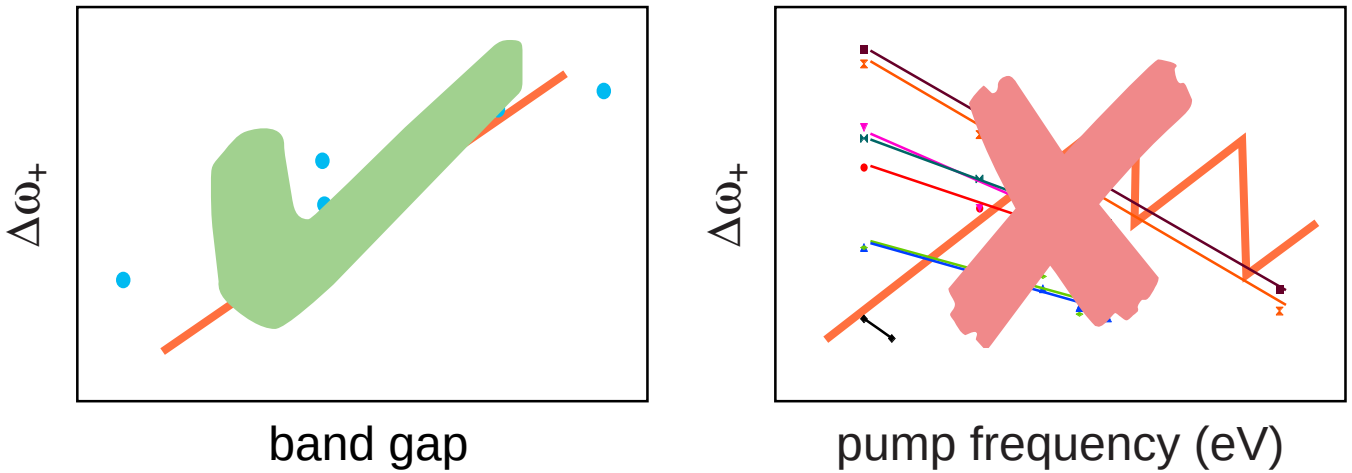
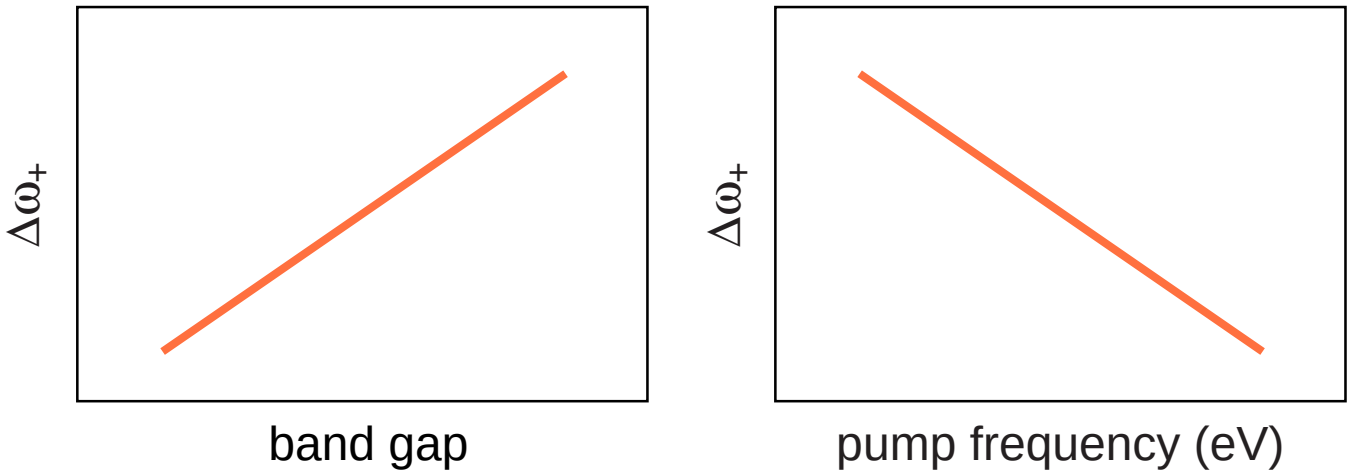


Comparison with models

2. group-velocity dispersion limits intensity at focus



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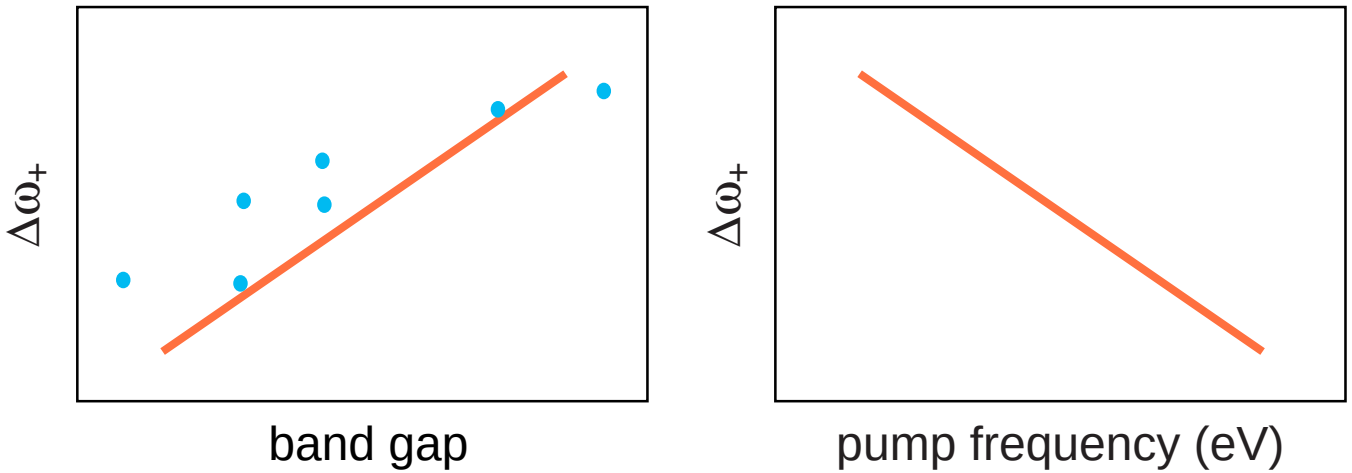

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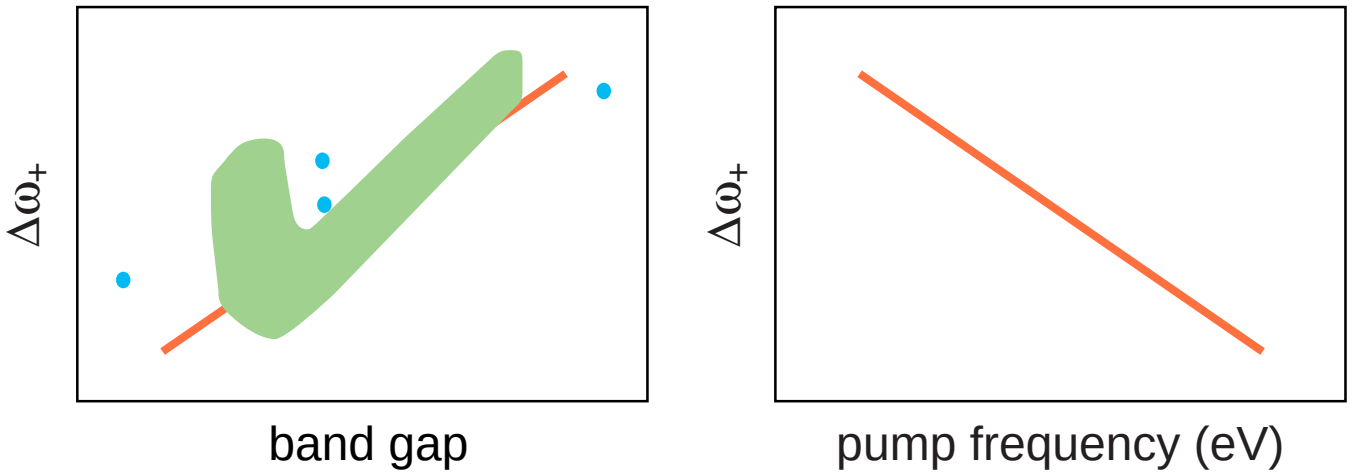

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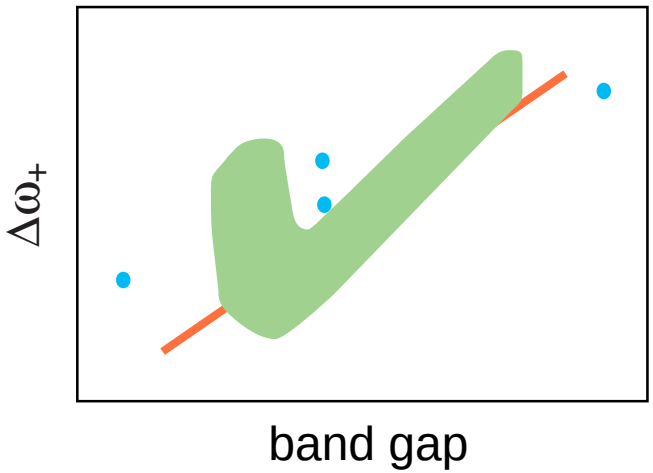

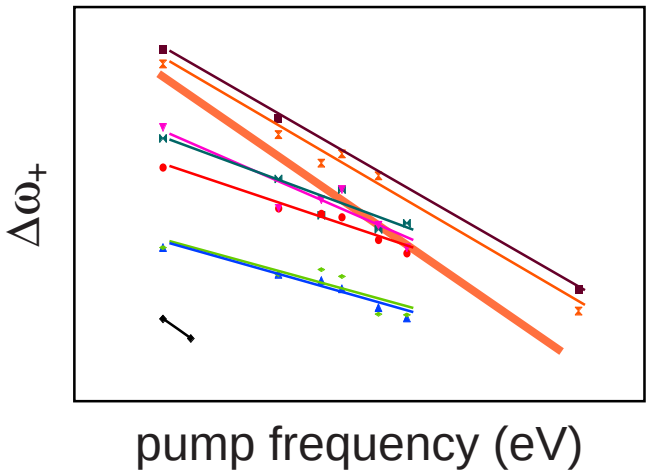

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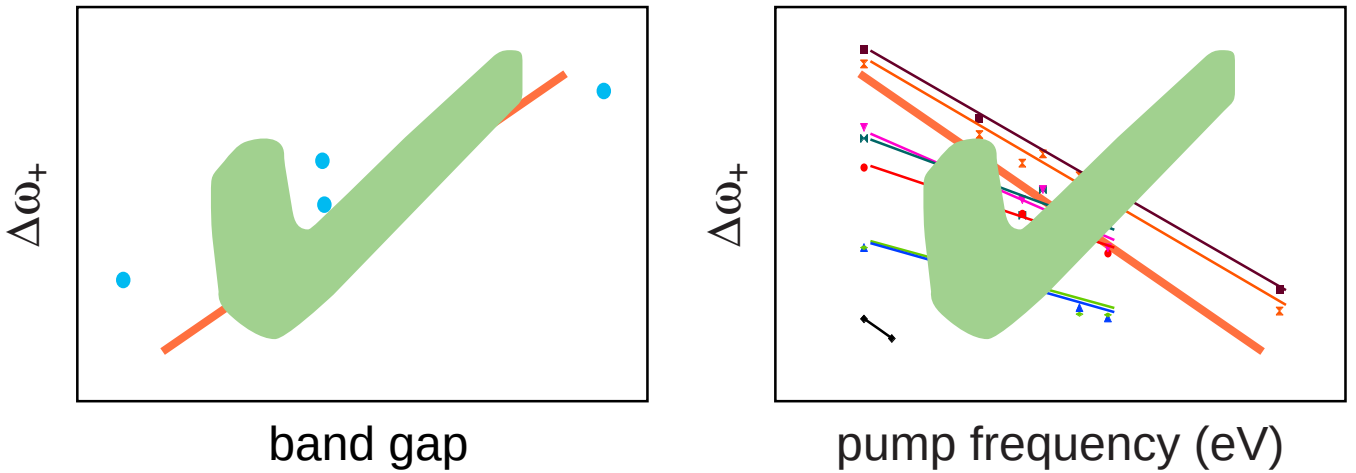

Summary

- need large bandgap and infrared pump
- broadening limited by group-velocity dispersion

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Acknowledgements:
Profs. Gaeta and Bloembergen

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