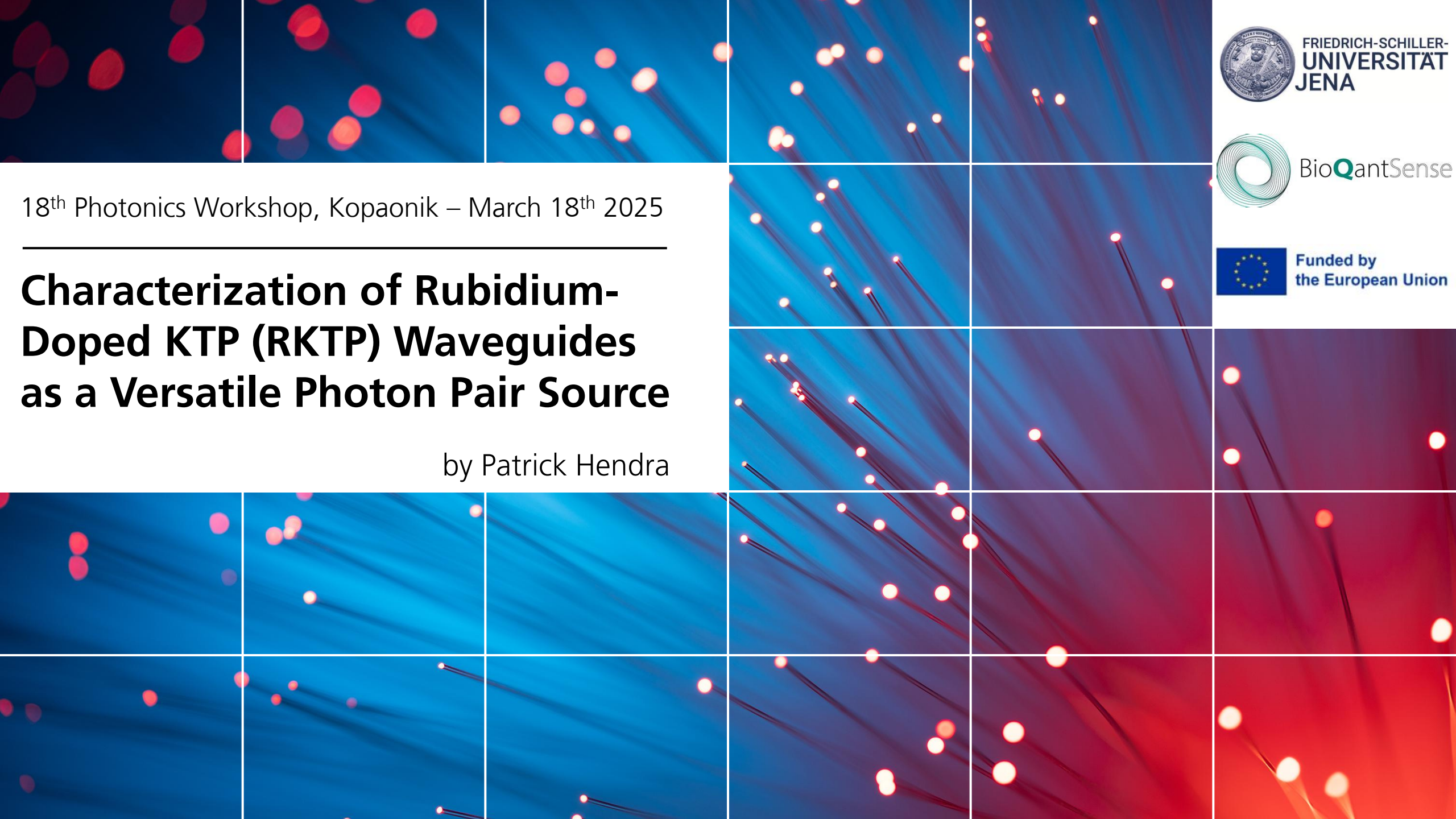

FRIEDRICH-SCHILLER-
UNIVERSITÄT
JENA

BioQantSense

Funded by
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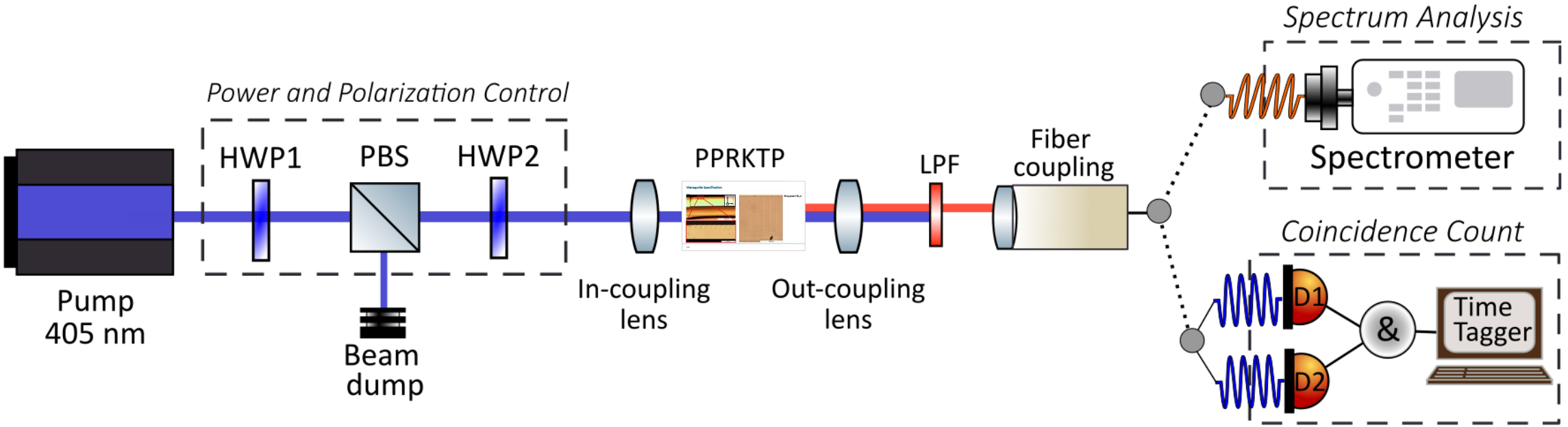
Characterization of Rubidium-Doped KTP (RKTP) Waveguides as a Versatile Photon Pair Source

by Patrick Hendra

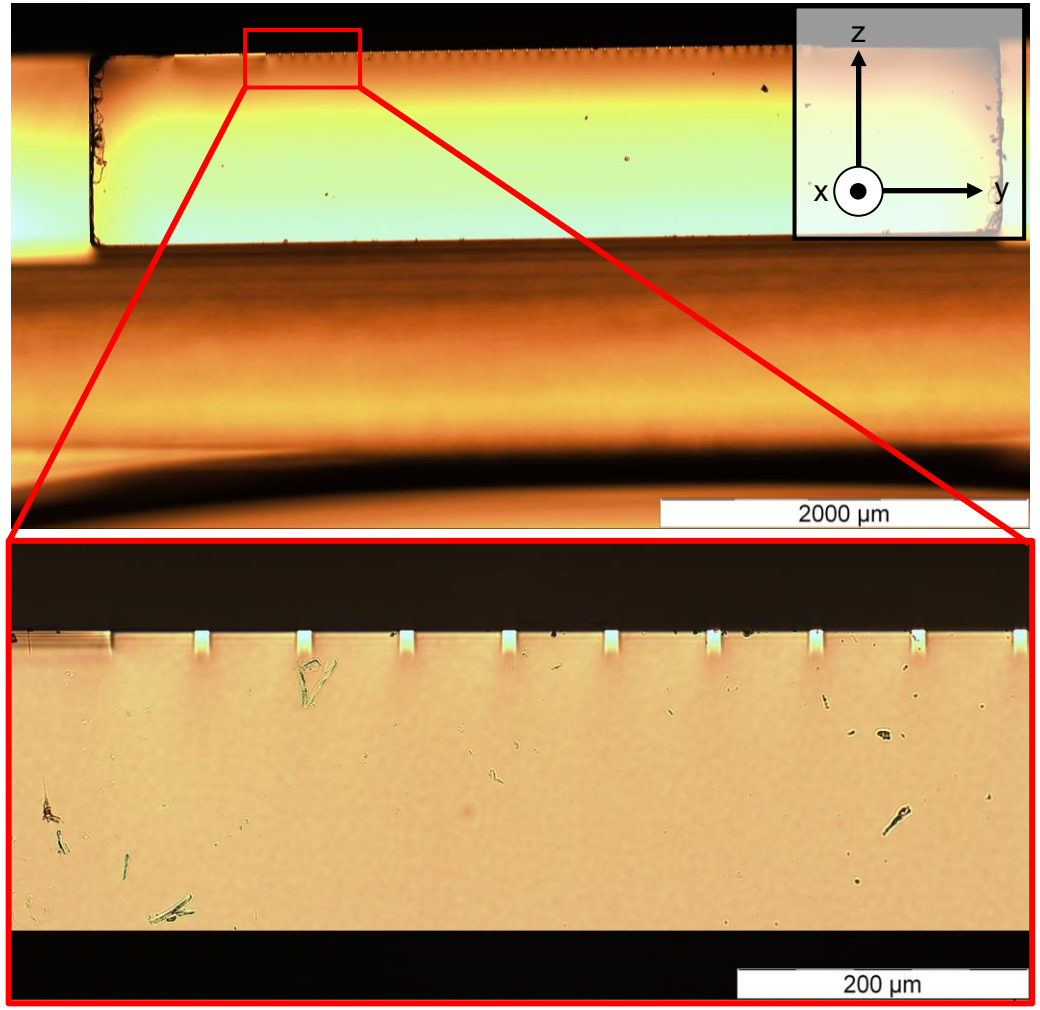
Content

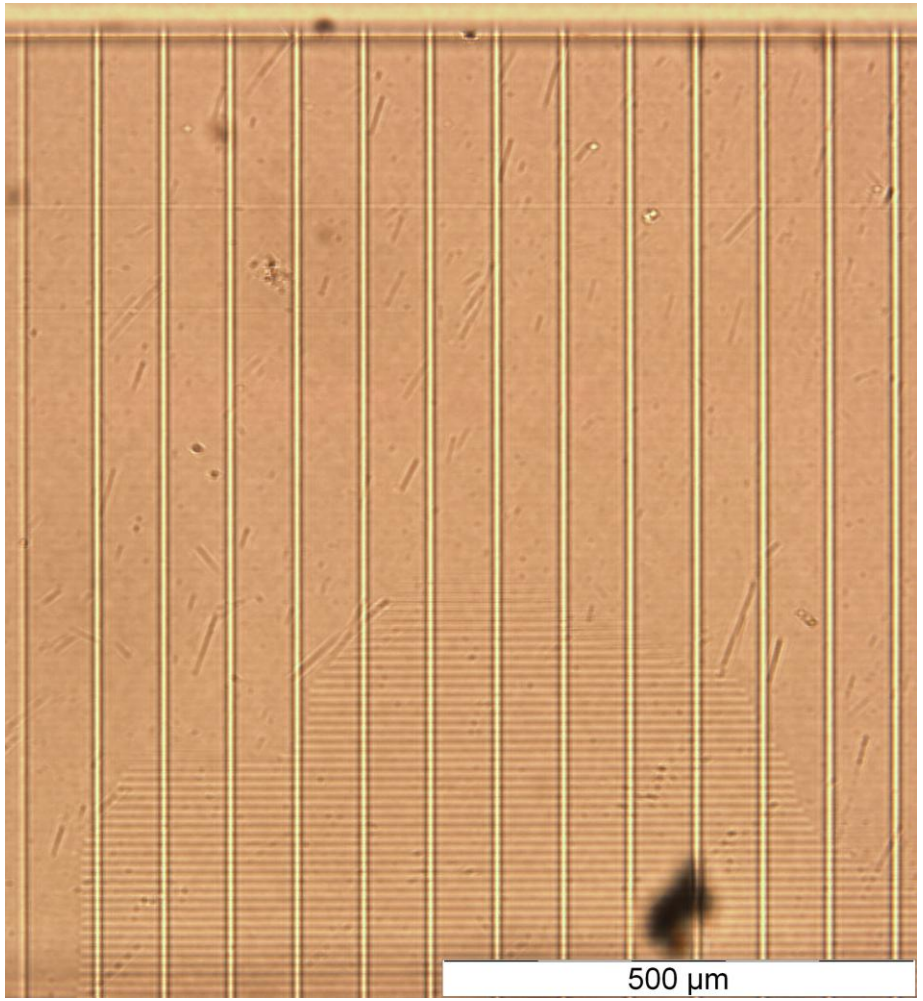
- Experimental setup
- Characterization results:
  - Spectral evolution
  - Coincidence rate
- Novel characteristic

Characterization Setup



Waveguide Specification





Poling period: 9.96 µm

Spectral Characterization of the Type-0 : $\updownarrow_p \Rightarrow \updownarrow_s + \updownarrow_i$

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Spatial modes in waveguided parametric down-conversion

Andreas Christ,* Kaisa Laiho, Andreas Eckstein, Thomas Lauckner, Peter J. Mosley, and Christine Silberhorn
Max Planck Institute for the Science of Light, Günther-Scharowsky-Str. 1/Building 24, 91058 Erlangen, Germany
(Received 29 April 2009; published 18 September 2009)

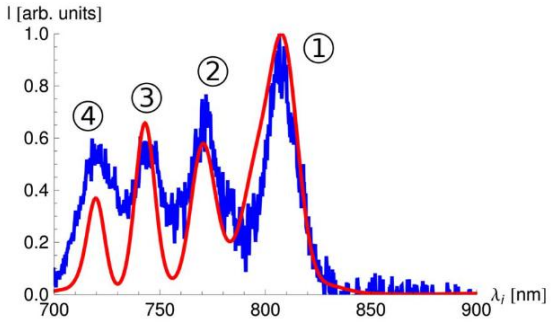
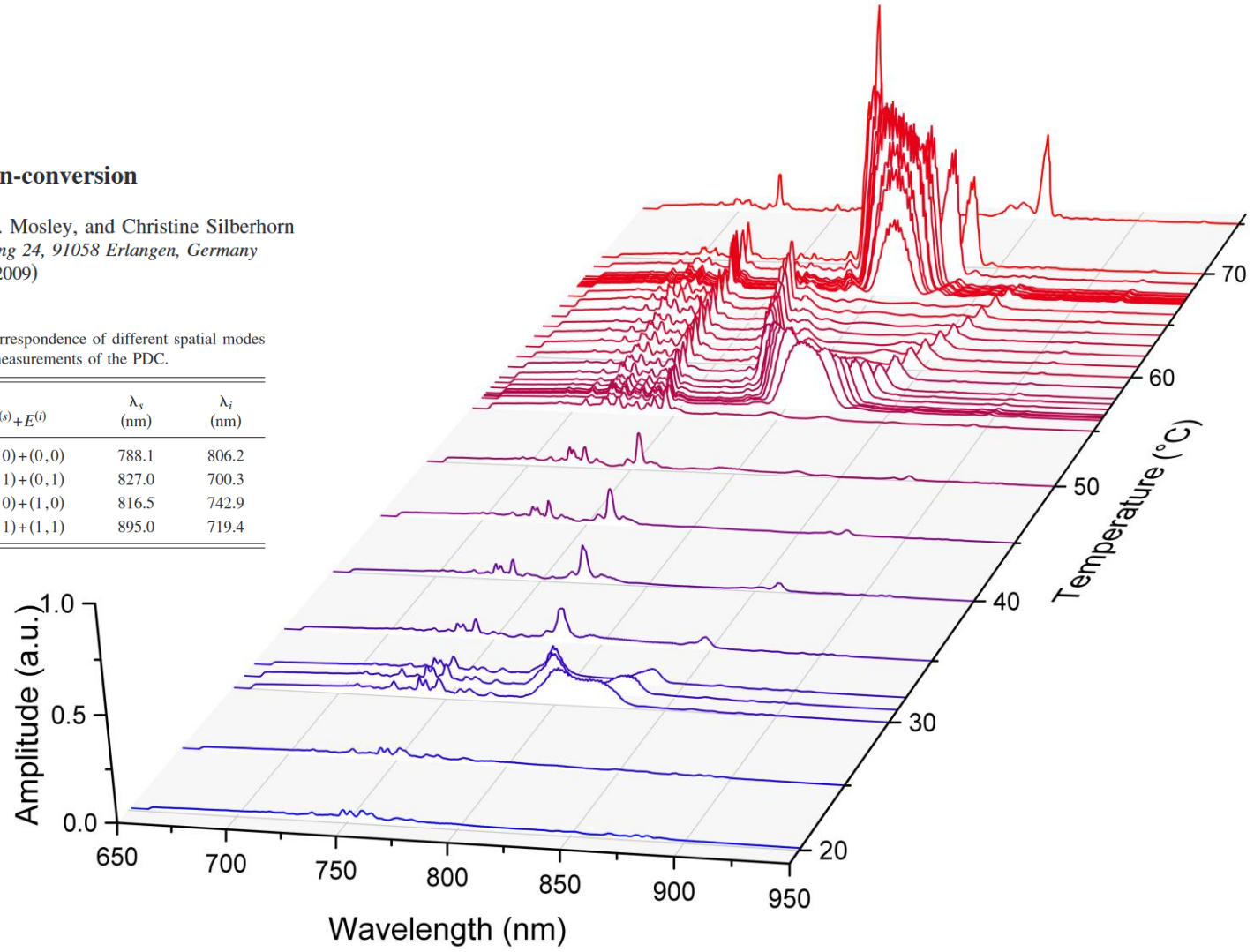
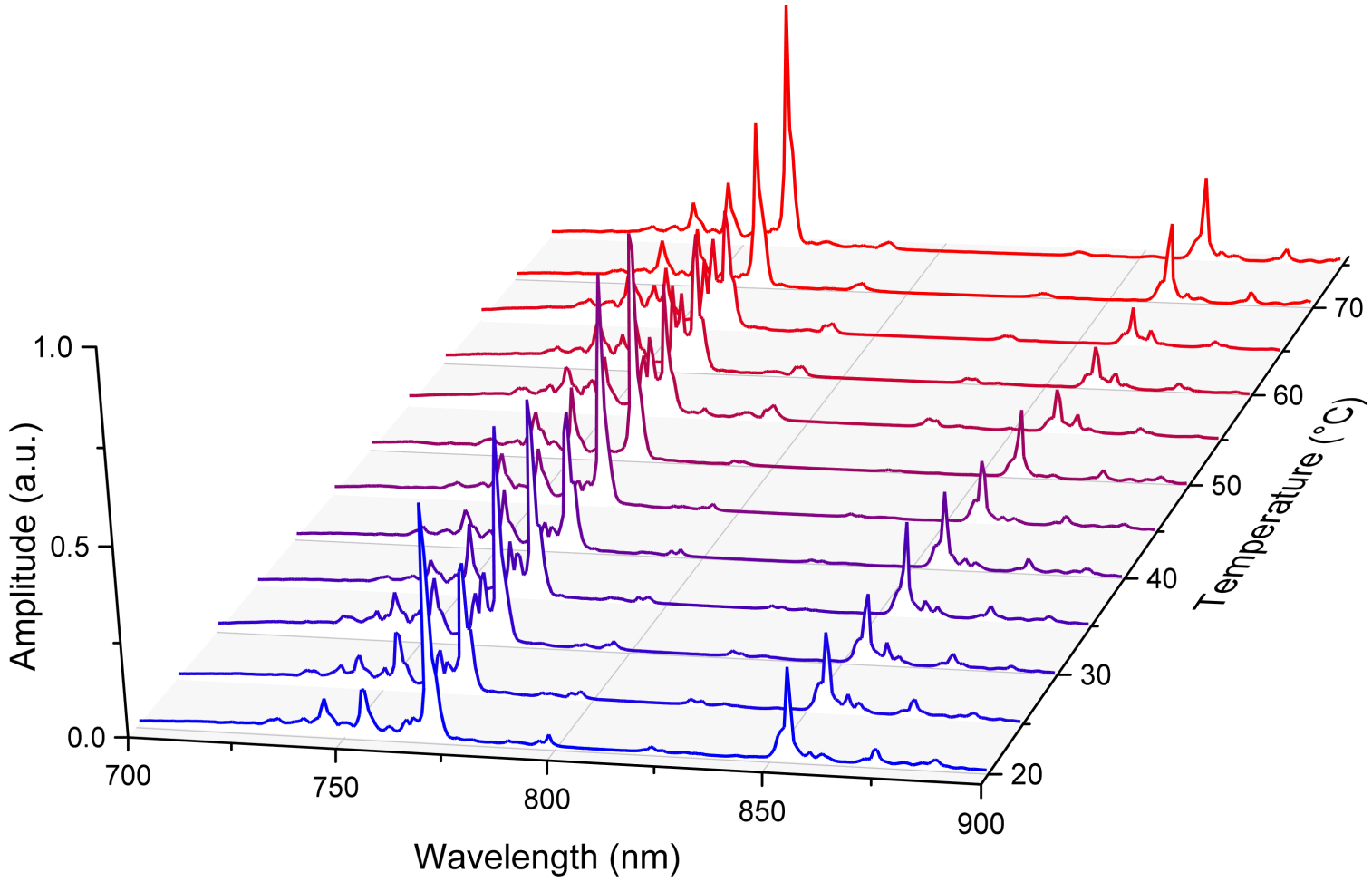


TABLE III. Spectral correspondence of different spatial modes observed in the marginal measurements of the PDC.

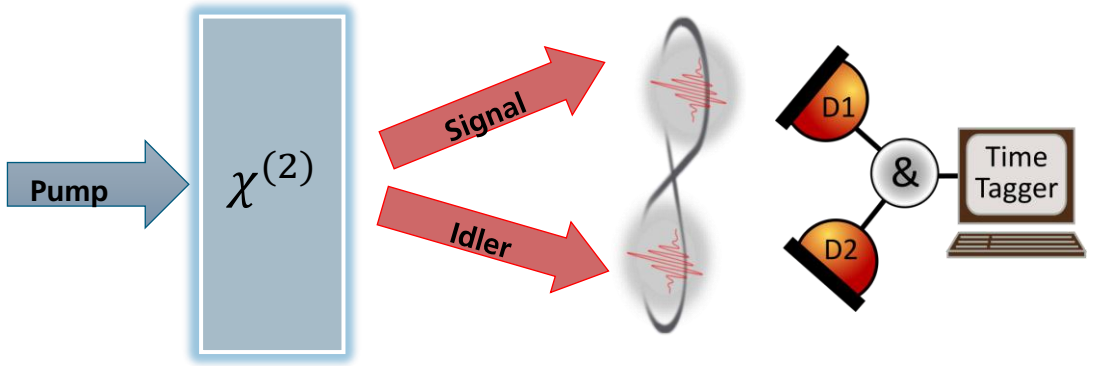
Proc.	$E^{(p)} \rightarrow E^{(s)} + E^{(i)}$	λ_s (nm)	λ_i (nm)
1	$(0,0) \rightarrow (0,0) + (0,0)$	788.1	806.2
2	$(0,0) \rightarrow (0,1) + (0,1)$	827.0	700.3
3	$(0,0) \rightarrow (1,0) + (1,0)$	816.5	742.9
4	$(0,0) \rightarrow (1,1) + (1,1)$	895.0	719.4



Spectral Characterization of the Type-II : $\leftrightarrow_p \Rightarrow \updownarrow_s + \leftrightarrow_i$

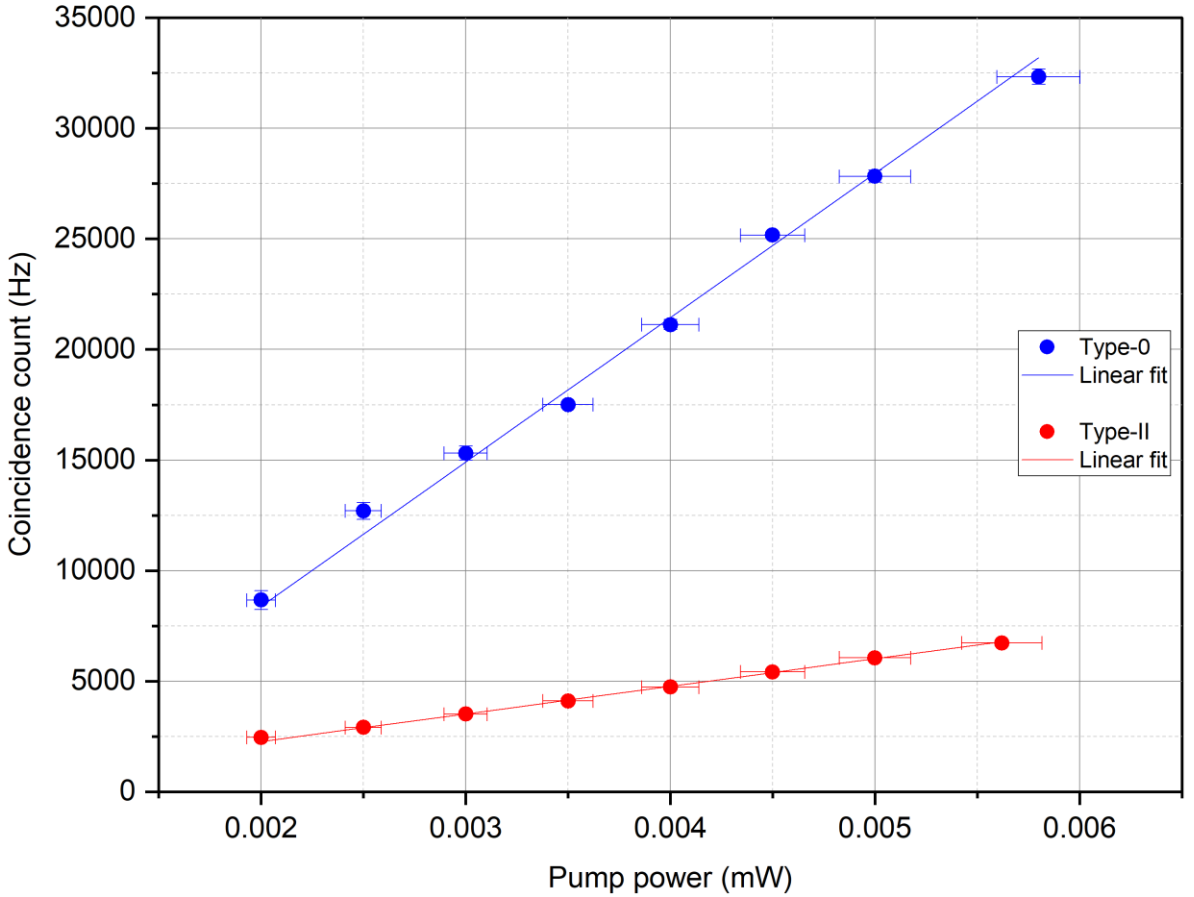


Photon-Pair Generation Rate

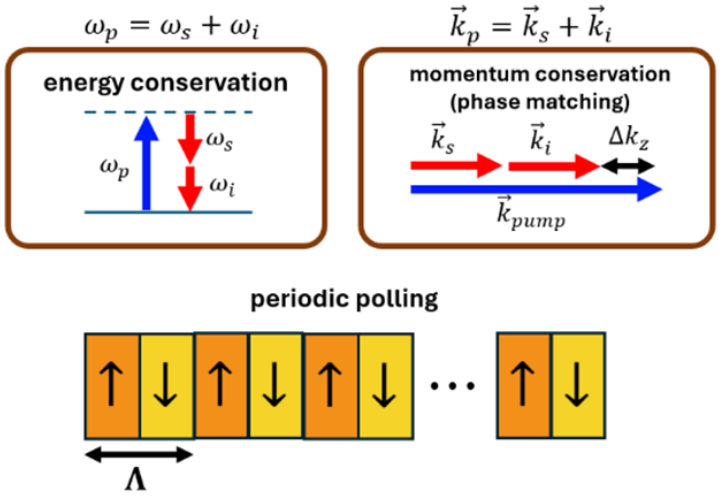


Type-0 : 10.8 MHz / mW pump

Type-II : 2.40 MHz / mW pump



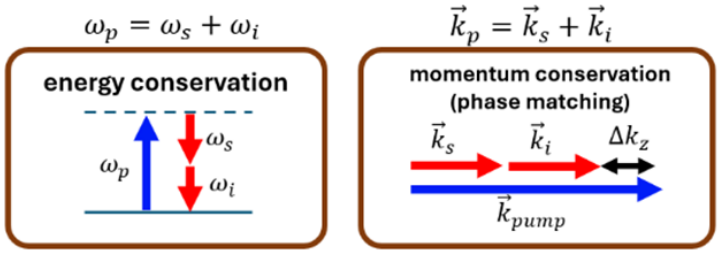
Quasi Phase Matching Equations

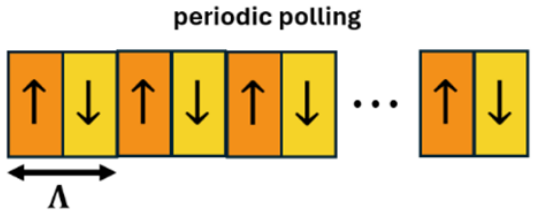


$$\text{Type}-0 : \text{V}_\text{p} \rightarrow \text{V}_\text{S} + \text{V}_\text{i} \; : \; \frac{2\pi n_z(\lambda_p)}{\lambda_p} = \frac{2\pi n_z(\lambda_s)}{\lambda_s} + \frac{2\pi n_z(\lambda_i)}{\lambda_i} + \frac{2\pi m_x}{\Lambda(T)} + k_{WG}$$

$$\text{Type}-\text{II}: \text{H}_\text{p} \rightarrow \text{V}_\text{S} + \text{H}_\text{i} \; : \frac{2\pi n_y(\lambda_p)}{\lambda_p} = \frac{2\pi n_z(\lambda_s)}{\lambda_s} + \frac{2\pi n_z(\lambda_i)}{\lambda_i} + \frac{2\pi m_y}{\Lambda(T)} + k_{WG}$$

Quasi Phase Matching Equations





poling order for type-0

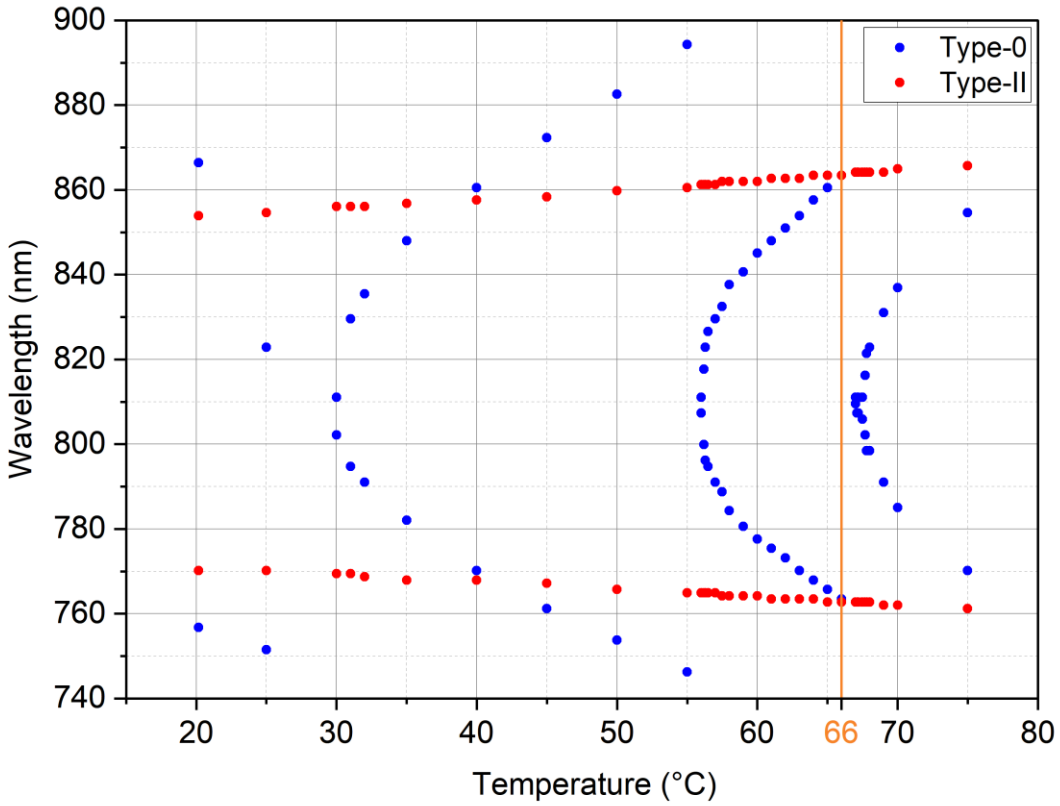
Waveguide contribution

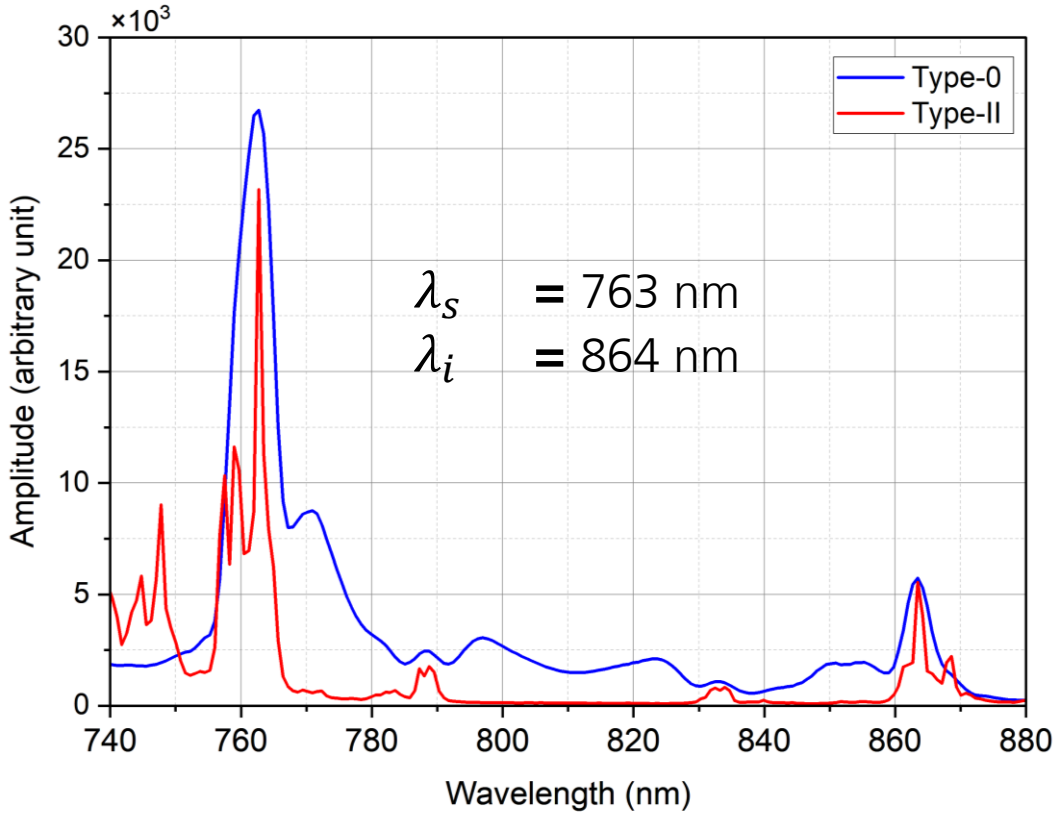
$$\text{Type}-0: \text{V}_\text{p} \rightarrow \text{V}_\text{S} + \text{V}_\text{i} \; : \; \frac{2\pi n_z(\lambda_p)}{\lambda_p} = \frac{2\pi n_z(\lambda_s)}{\lambda_s} + \frac{2\pi n_z(\lambda_i)}{\lambda_i} + \frac{2\pi m_x}{\Lambda(T)} + k_{WG}$$

poling order for type-II

$$\text{Type}-\text{II}: \text{H}_\text{p} \rightarrow \text{V}_\text{S} + \text{H}_\text{i} \; : \; \frac{2\pi n_y(\lambda_p)}{\lambda_p} = \frac{2\pi n_z(\lambda_s)}{\lambda_s} + \frac{2\pi n_z(\lambda_i)}{\lambda_i} + \frac{2\pi m_y}{\Lambda(T)} + k_{WG}$$

Finding the suitable wavelengths





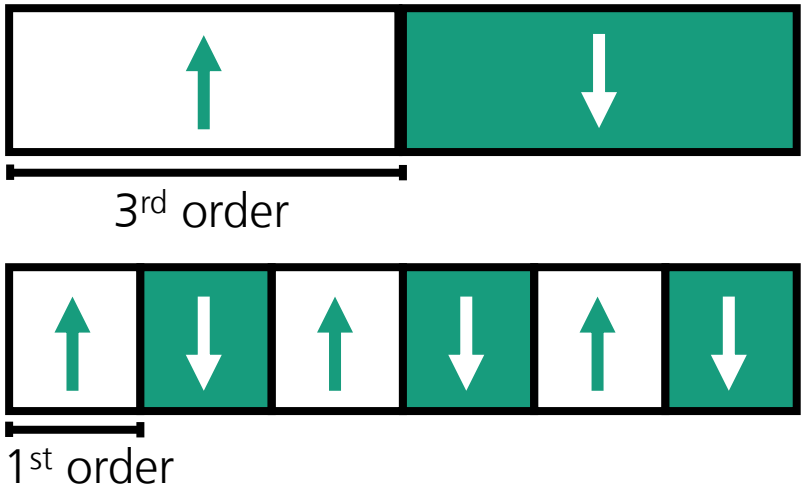
Poling Order of the QPM

$$\text{Type}-0 : 30.47 = 28.64 + 0.63\, m_x + k_{WG}$$

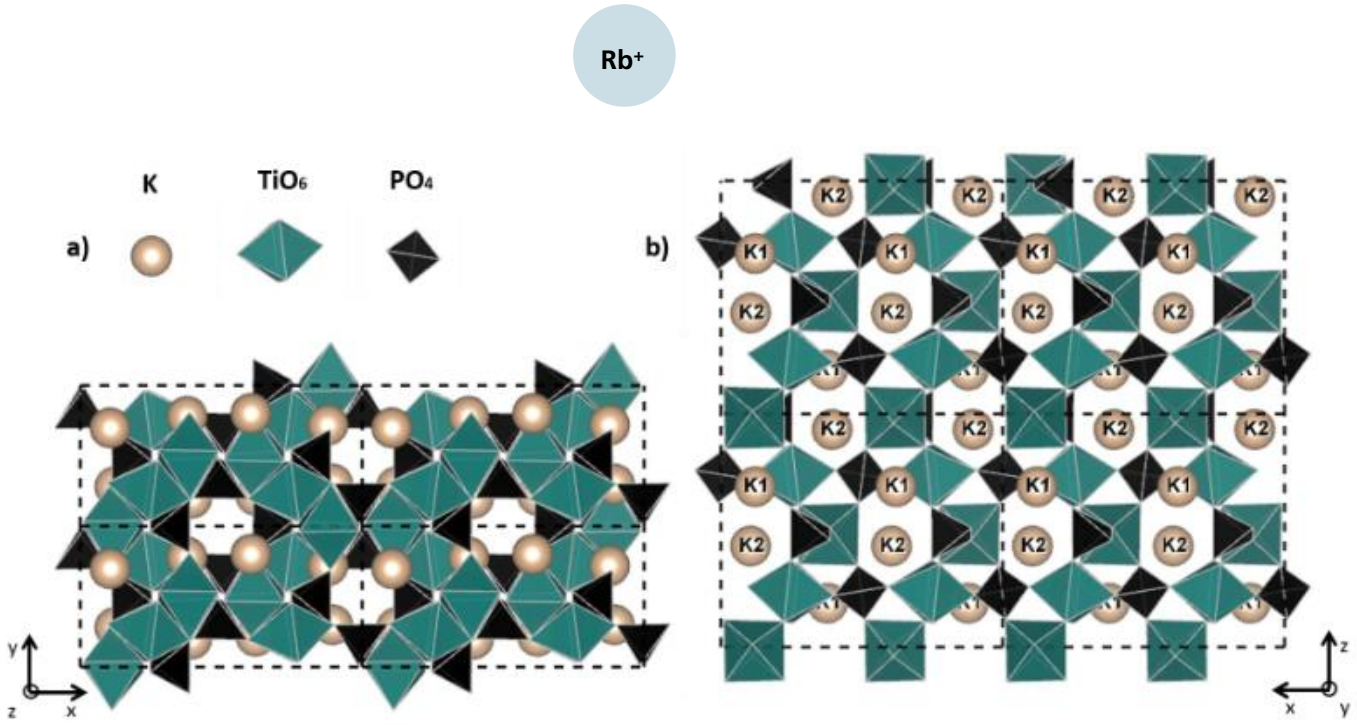
$$\text{Type}-\text{II} : 28.57 = 28.00 + 0.63\, m_y + k_{WG}$$

$$\text{Type}-0 : m_x = 3$$

$$\text{Type}-\text{II} : m_y = 1$$



Rubidium-doped KTP



- The ionic conductivity is reduced by 2 orders of magnitude
- Rb doping allows smaller poling period

Mutter, P. (2022). *Quasi-phase matched devices in Rb-doped KTiOPO4*. Doctoral Thesis in Physics, KTH Sweden. http://www.diva-portal.org/smash/get/diva2:1711458/FULLTEXT01.pdf

Thank you for your attention

Full result is published at https://doi.org/10.1364/JOSAB.567775