Numerical modelling of conical wave formation in multimode optical fibers
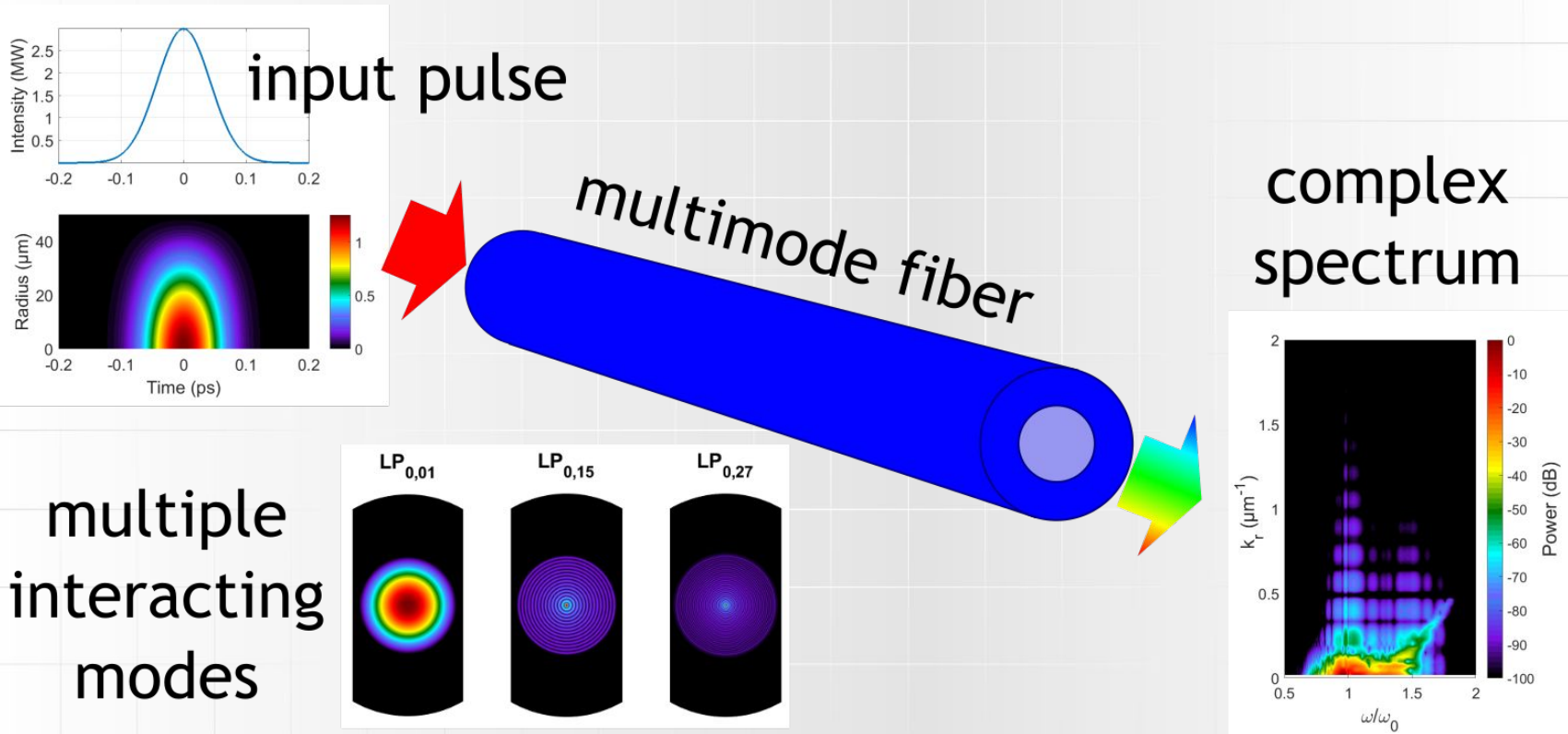
Sylwia Majchrowska[1]
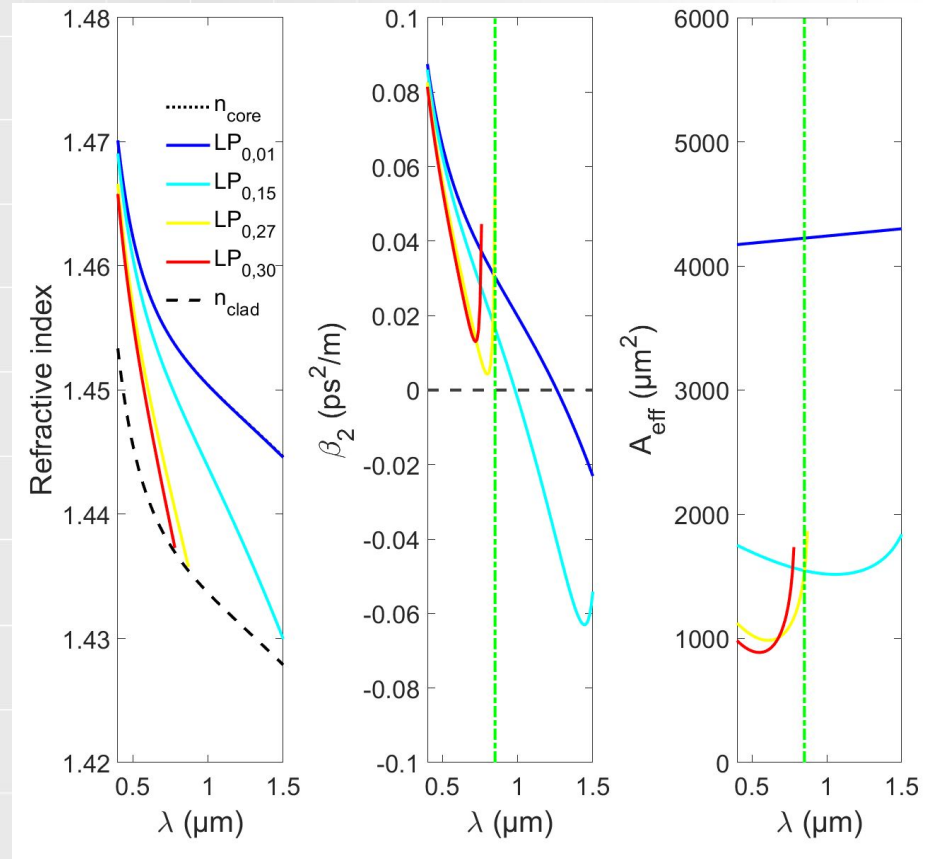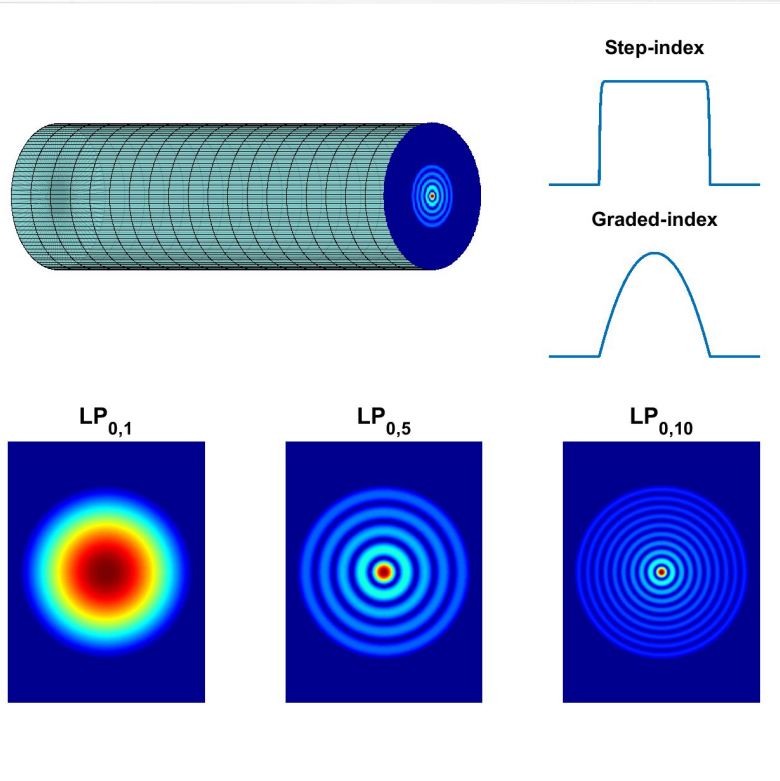Karol Tarnowski[1], Pierre Bejot[2],
Bertrand Kibler[2]

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[2] Laboratoire ICB, UMR6303 CNRS-Universite Bourgogne Franche-Comte, 21078 Dijon, France
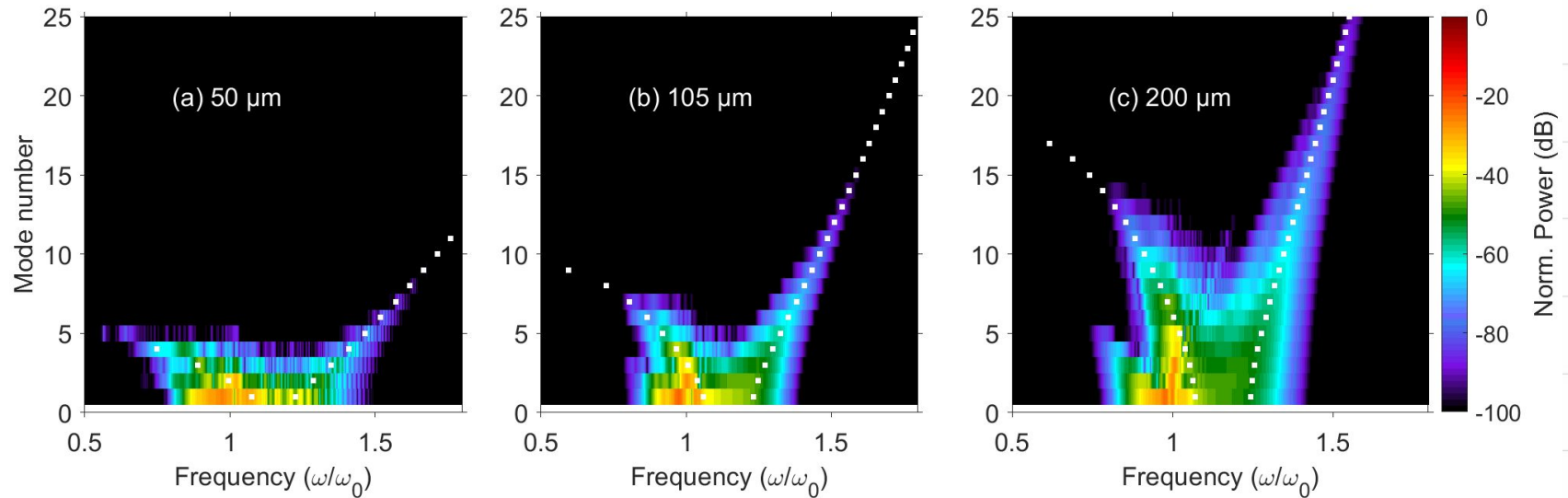
Wrocław University of Science and Technology

Introduction and objectives

Multimode optical fiber
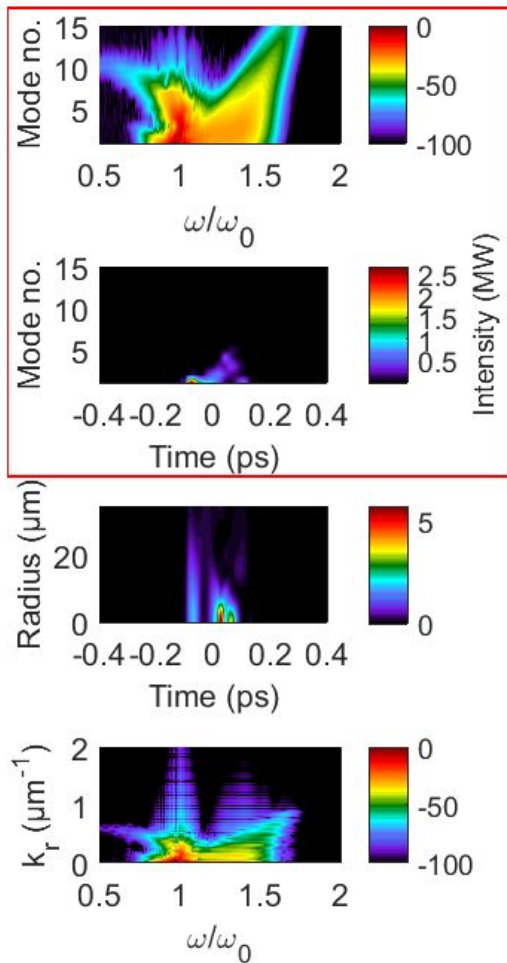
Discretized Conical Waves

The spectral position of conical wave component in each mode can be predicted by using the following phase-matching condition

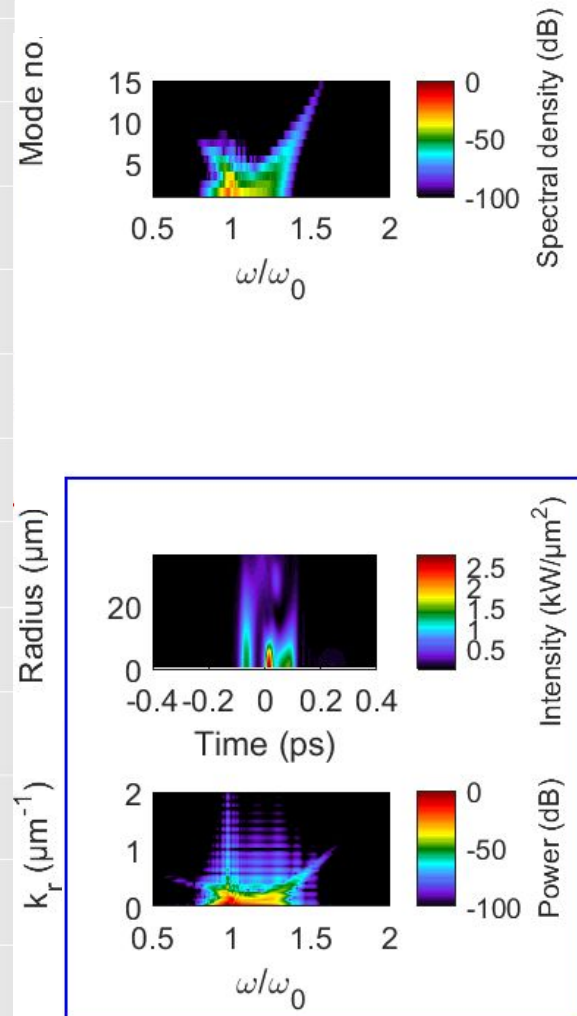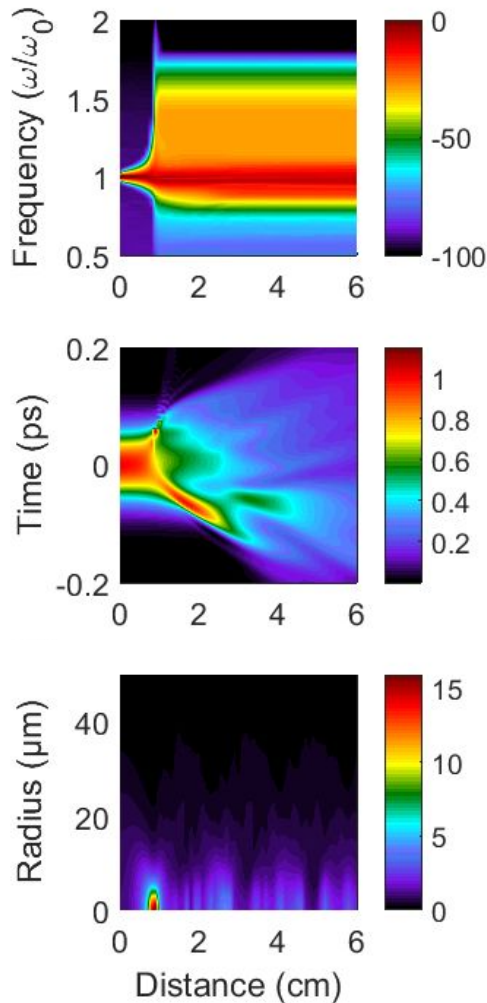$$\beta(m, \Omega) - |\beta_0 + \delta\beta_0| - |\beta_1 + \delta\beta_1|\Omega = 0$$

B. Kibler and P. Bejot. Discretized Conical Waves in Multimode
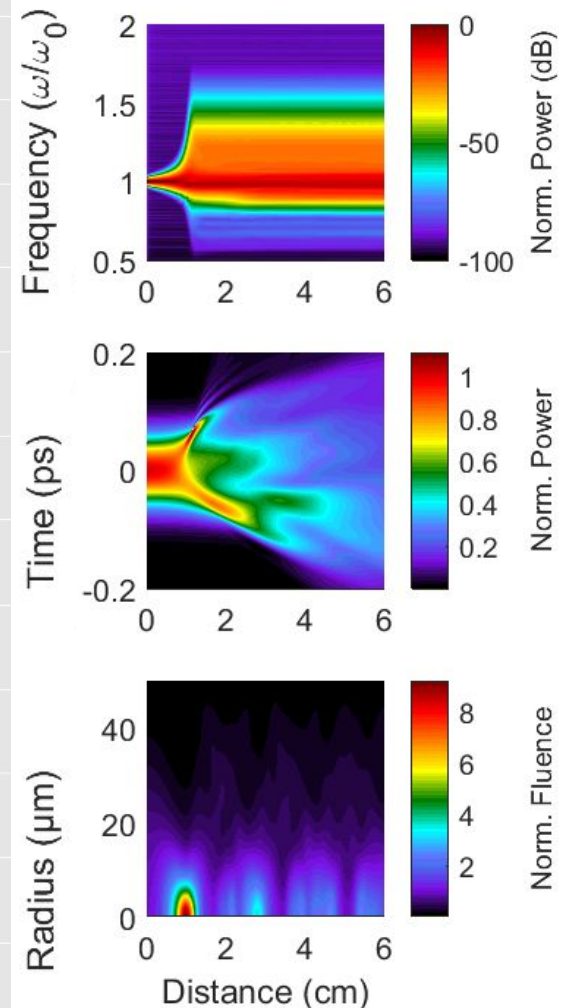Optical Fibers. Physical Review Letters, 126(2):023902, 2021

Numerical modelling
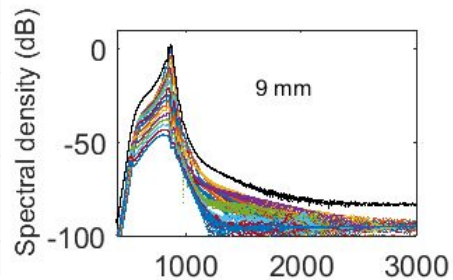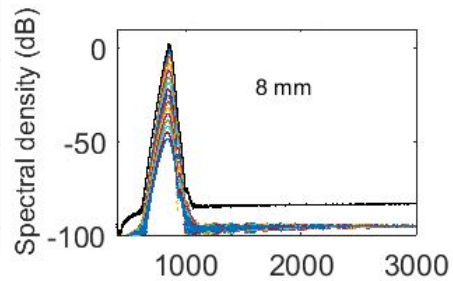
MM-GNLSE
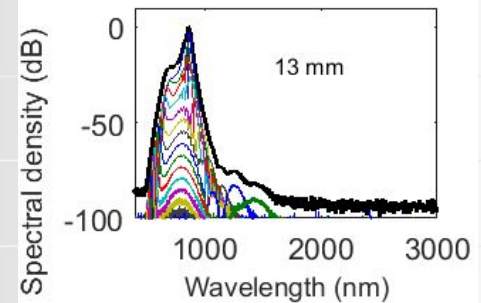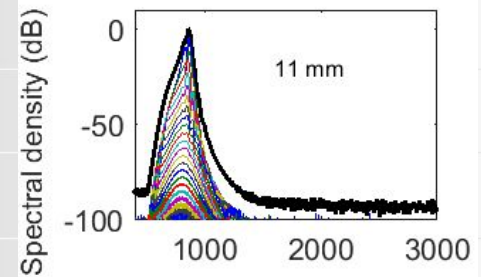
MM-UPPE

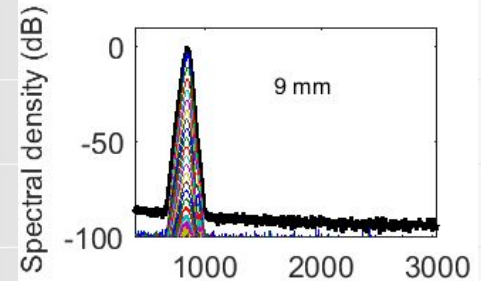# Evolution of integrated spectrum

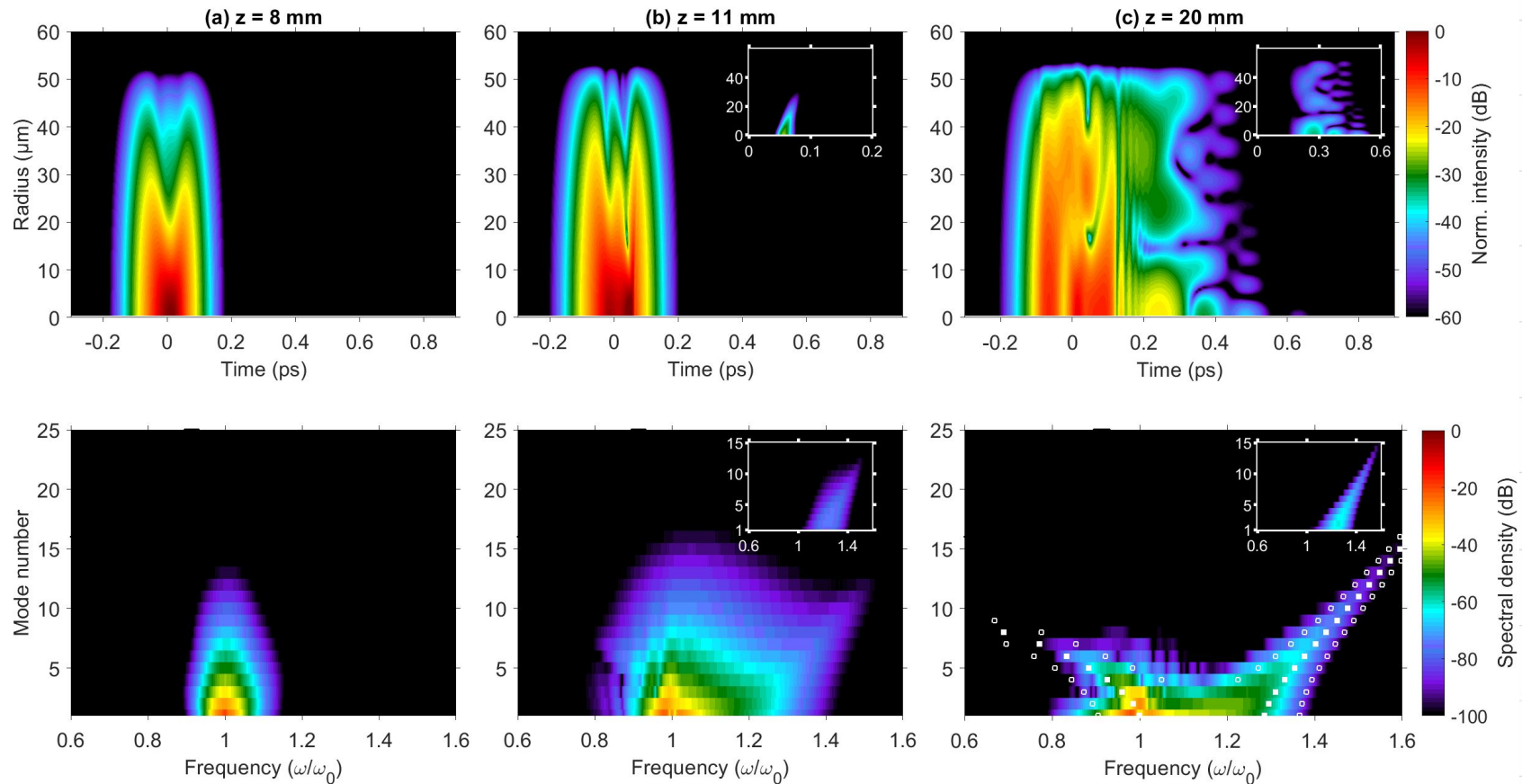## MM-GNLSE

MM-UPPE

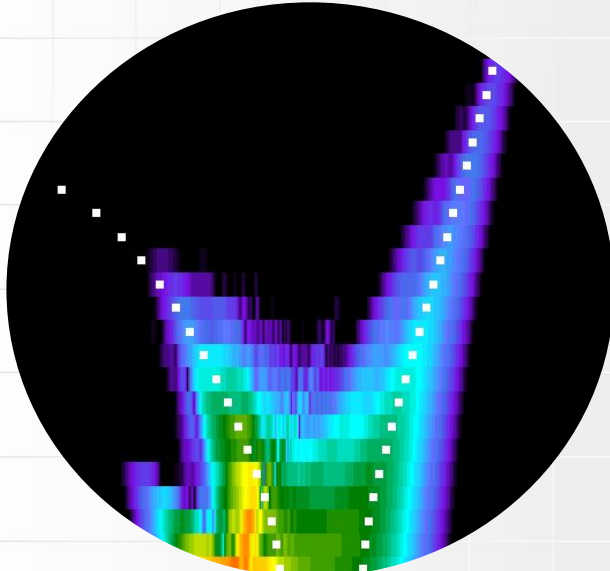# Conical wave formation

MM-GNLSE
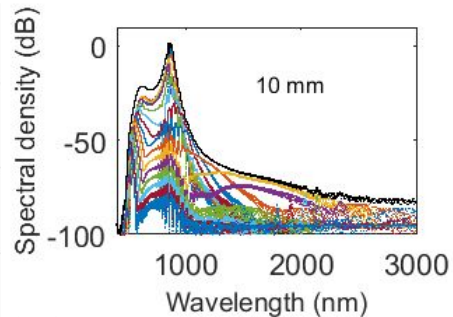
MM-UPPE

Closer look with MM-UPPE

Summing up

✔ We numerically studied discretized conical waves formation in multimode fibers using two well-known modeling approaches.

✔ Spectral positions of conical wave components are in good agreement with theoretical predictions.

✔ The difference in the nonlinear step of modelings is the main origin of discrepancies.
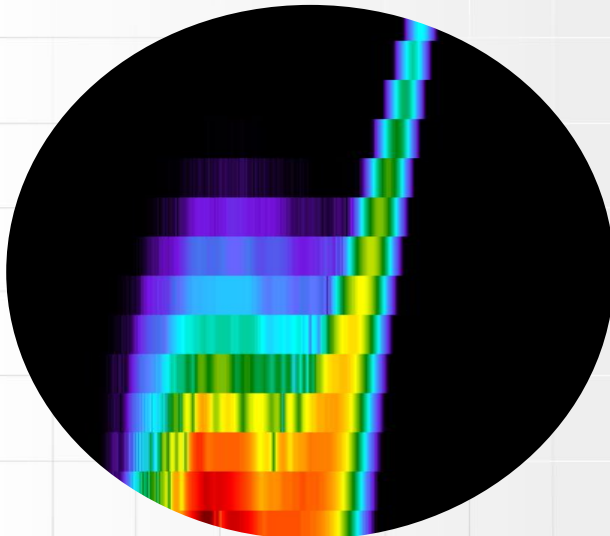
✔ Our numerical studies have shown that outcomes from both models are qualitatively in good agreement.

✔ Experimental works in the topic are on-going.

Acknowledgments

This work is supported by:

Thank you for your attention.