MOCCA ESRs' Newsletter

In this issue:

MOCCA ESR Avinash Kumar's project: "Integrated Frequency Combs"

MOCCA ESR Avinash Kumar presents his project.

Read more on page 2-3.

Find out more about MOCCA EID project

https://mocca.astonphotonics.uk/

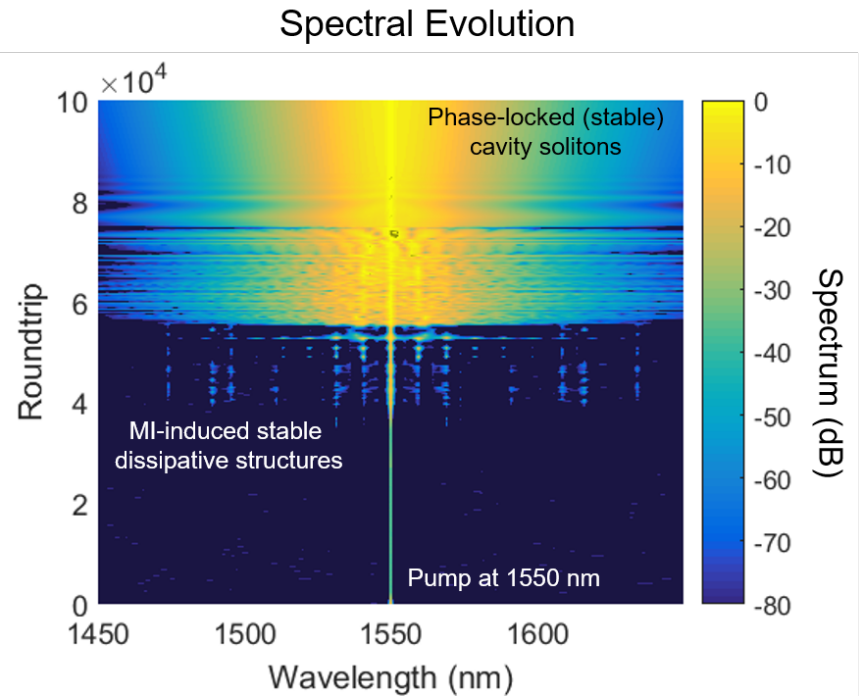
Or follow us on

@MOCCA_EID

MOCCA is funded by the European Union's Horizon 2020 Research and Innovation Program under the Marie Skłodowska-Curie grant agreement No 814147

ABOUT MY PROJECT AND ITS PROGRESSES

The title of my project is: "Integrated Frequency Combs".
It aims to generate new frequencies from visible to mid-IR spectrum and utilizing them for high precision spectroscopy through comb generation.



At AMO, we are developing the above-mentioned technology on a well-established & sustainable CMOS platform.
Considering CMOS compatible integrated photonics platforms, Si (Silicon) and Si3N4 (Silicon Nitride) have been the way to go as shown in the research over the years. In this project, we are using Si3N4 for having negligible loss at the laser source (1550 nm/ 193.4 THz) in use.
The exploited Si3N4 property here is the high third-order optical nonlinearity, which results in comb generation through four wave mixing (parametric nonlinear process). Various designs for comb generation through Si3N4 have been already proposed based on different

figures of merit. In this project, we are focusing on ring shaped resonators. These resonators are an ideal testbed to enhance the optical nonlinearity of the photonic platform. We used device and circuit level photonic simulations for the device design optimized for comb generation at source wavelength of 1550 nm (Figure 1).

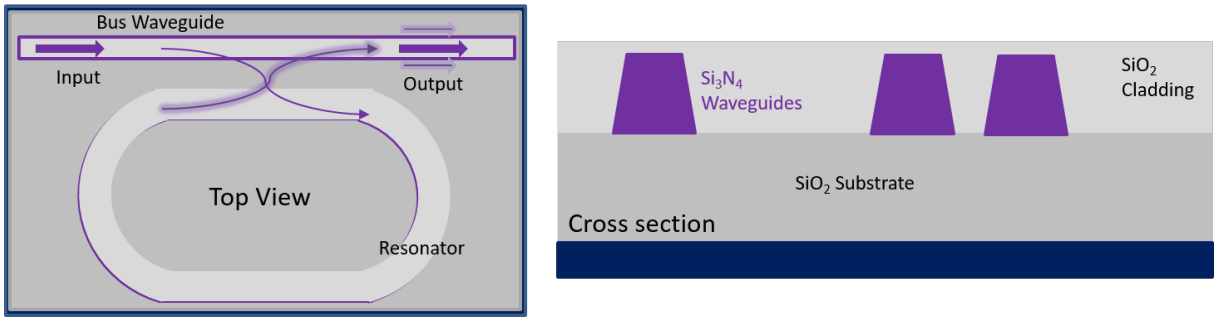


Figure 1: Schematic diagram of the resonator device, top view (left side) & cross section (right side).

Nonlinear simulations for comb generation were done in collaboration with partners from Sapienza University of Rome. to describe the comb generation, we used the lugiato-lefever equation (lle) with a continuous laser pump at 1550 nm in the normal dispersion regime. We firstly verified the resultant code by reproducing the already published results based on the same formulation of lle and then used it with the device parameters under consideration for fabrication. With the help of the above simulations, we were able to understand the dynamics of comb formation in our device (theoretically) and estimated that we can reach the threshold power needed for comb generation on our on-chip resonators.

Now, the device fabrication is on the way. Check out the **next MOCCA newsletter** for more!!

Or… you can follow the progress of the project on **my blog**:
https://mocca.astonphotonics.uk/avinashs-blog/

You can follow the progress of MOCCA ESR's research on our blogs and social media:

See https://mocca.astonphotonics.uk/blog/

MOCCA_EID is a project coordinated by Aston Institute of Photonic Technologies, Aston University Birmingham.

MOCCA's Partners:

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie grant agreement No 814147