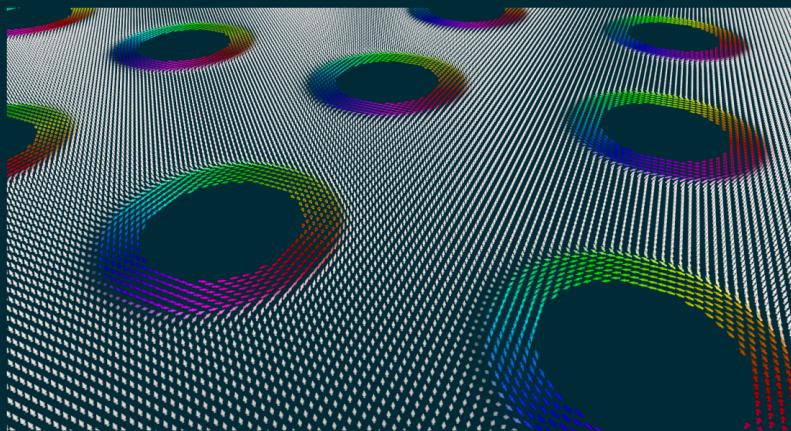


DYNAMICAL COUPLING OF BULK AND EDGE MODES IN ANTIDOT MULTILAYERS WITH PERPENDICULAR MAGNETIC ANISOTROPY



Mathieu Moalic*
Mateusz Zelent
Maciej Krawczyk

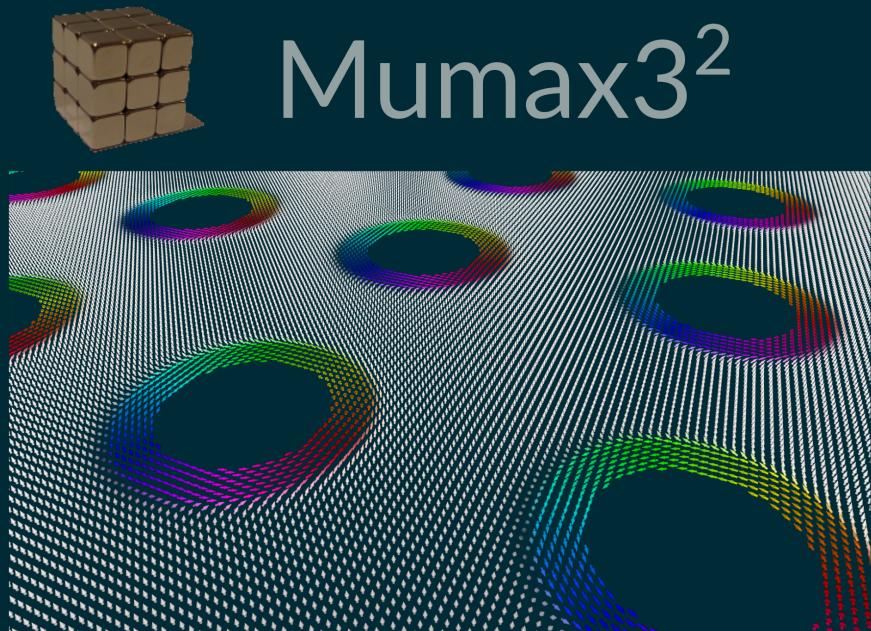
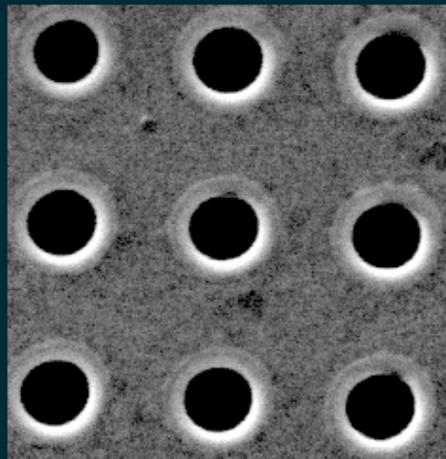
* matmoa@amu.edu.pl



ADAM MICKIEWICZ
UNIVERSITY
POZNAŃ

<ISQI> INSTITUTE OF SPINTRONICS
AND QUANTUM INFORMATION

Experiments¹

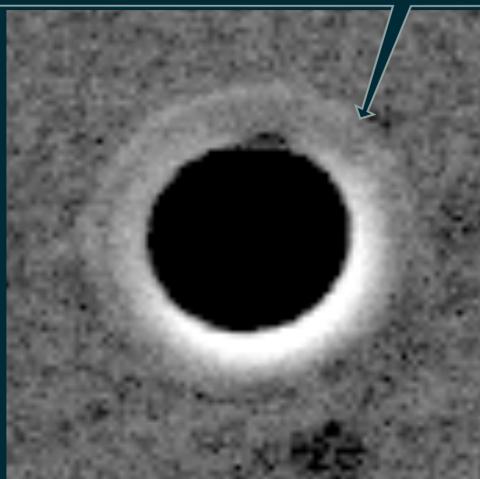


Mumax3²

[1] Pan, S., et al. "Edge localization of spin waves in multilayers with perpendicular magnetic ." Physical Review B 101.1 (2020): 014403.

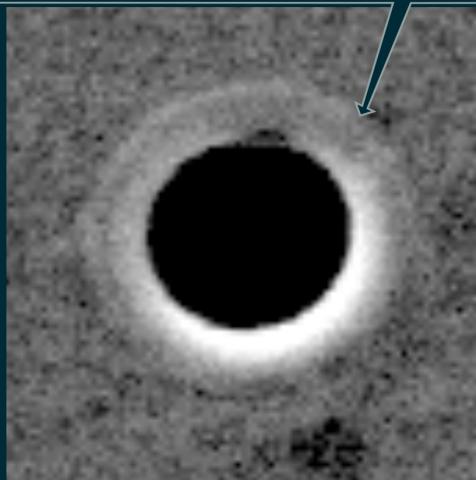
[2] "The design and verification of mumax3", AIP Advances 4, 107133 (2014).

Defects in the rim around the
antidot from the focused ion beam



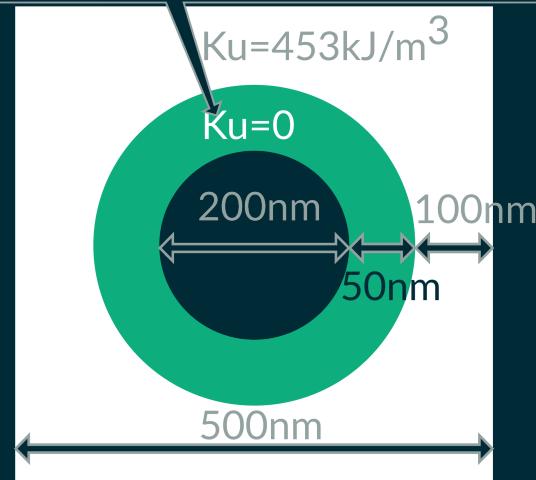
Scanning electron microscopy

Defects in the rim around the
antidot from the focused ion beam

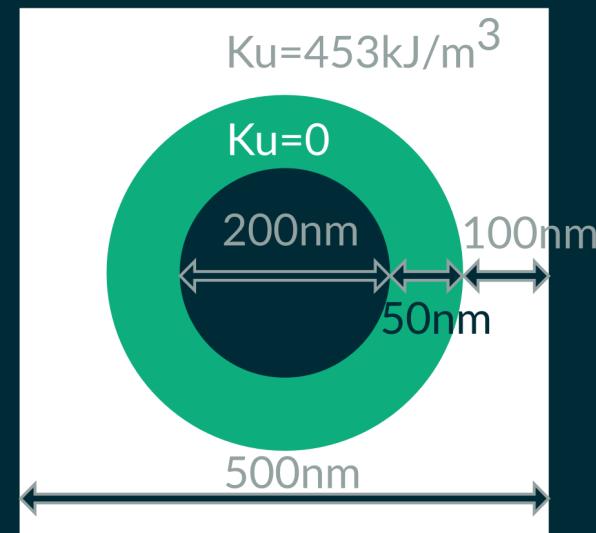
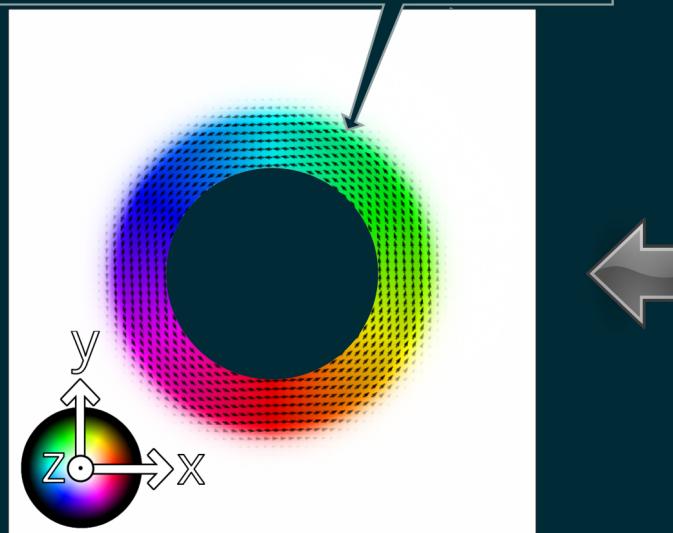


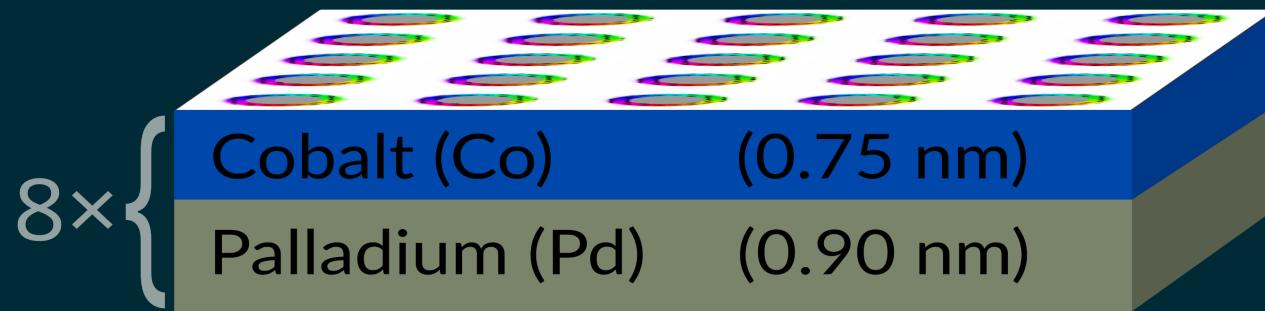
Scanning electron microscopy

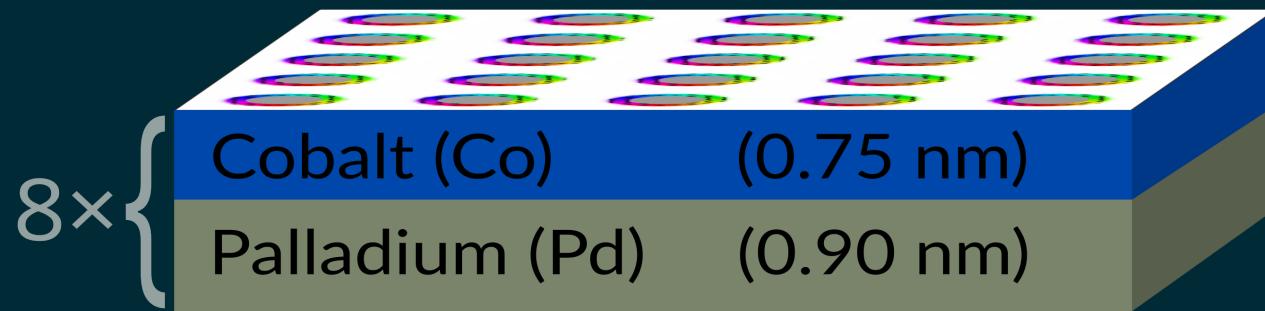
Fitted in simulations by adding
destroyed anisotropy in the
rim around the antidot

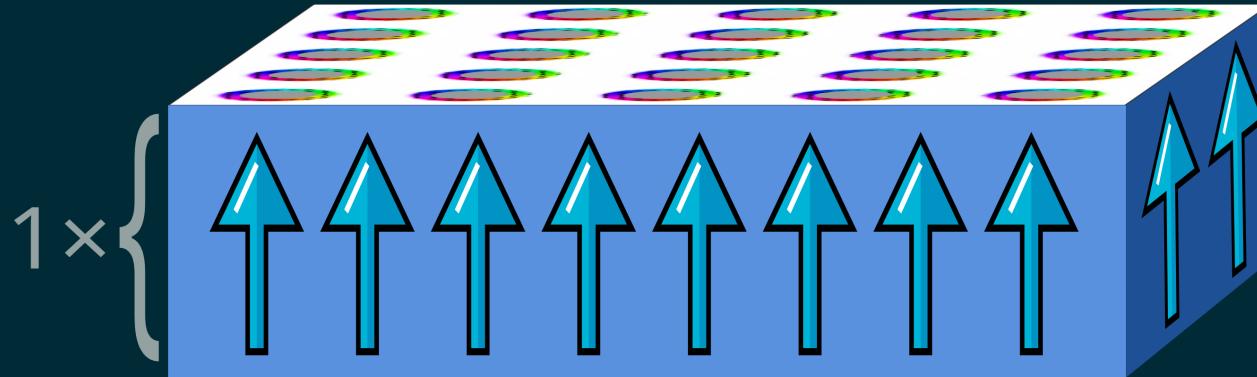


We chose to only consider a counter-clockwise vortex-like state in the rim









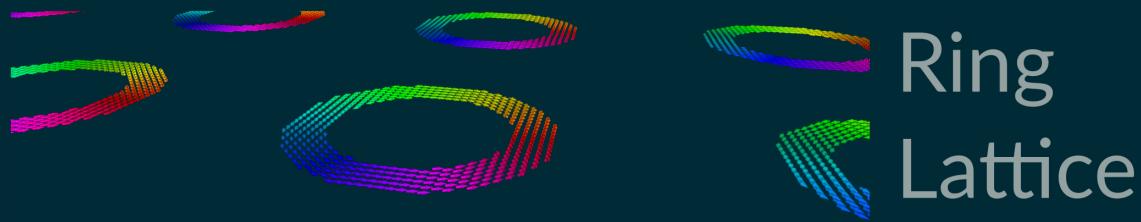
Magnetization Saturation = 810 kA/m

Exchange Stiffness = 13 pJ/m

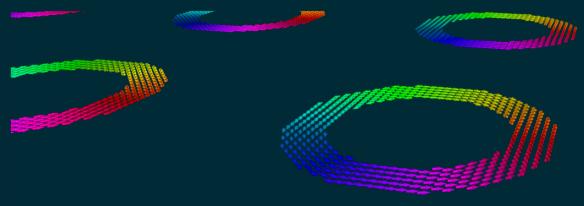
Out-of-Plane Anisotropy = 453 kJ/m³

Gyromagnetic ratio = 187 rad.GHz/T

Pal, S., et al. "Tunable magnonic frequency and damping in [Co/Pd] 8 multilayers with variable Co layer thickness." Applied Physics Letters 98.8 (2011): 082501.

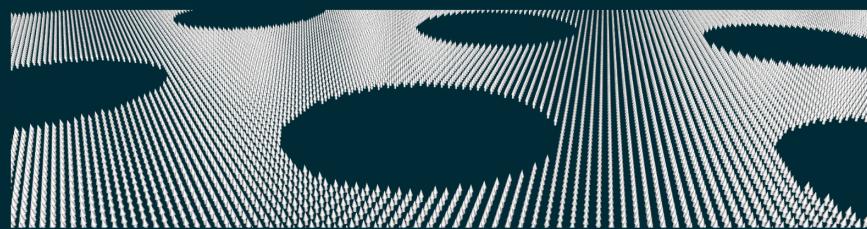


Ring
Lattice

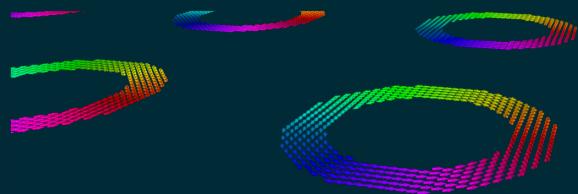


Ring
Lattice

+

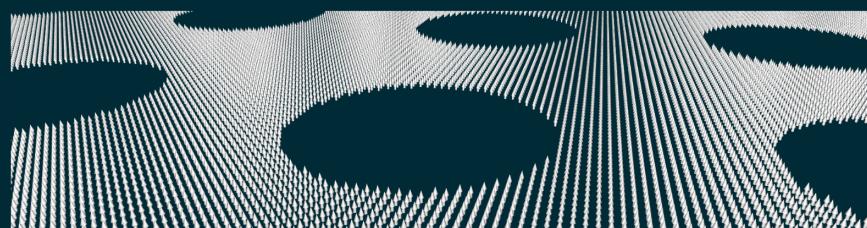


Antidot
Lattice



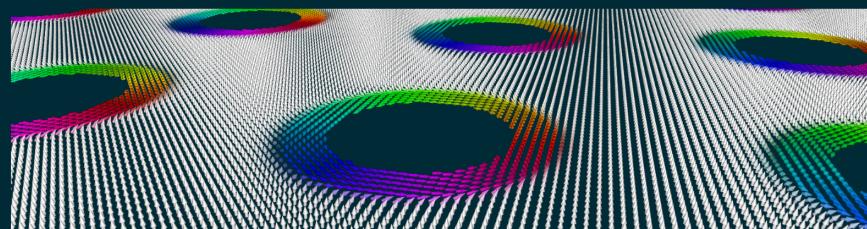
Ring
Lattice

+

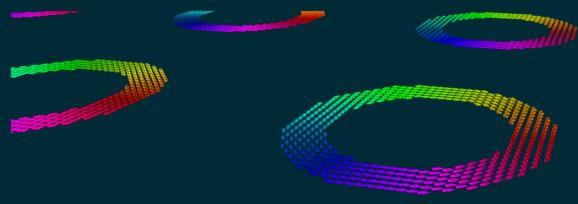


Antidot
Lattice

=

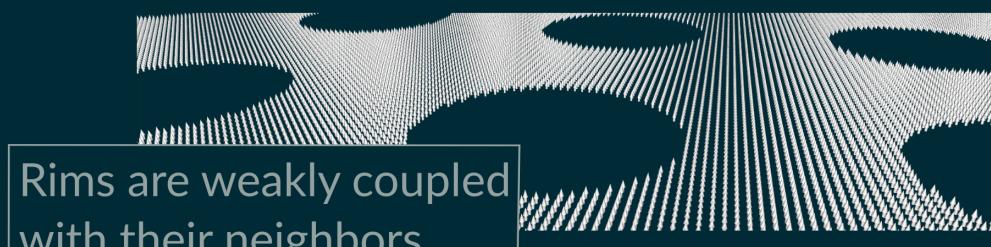


Combined
Lattice



Ring
Lattice

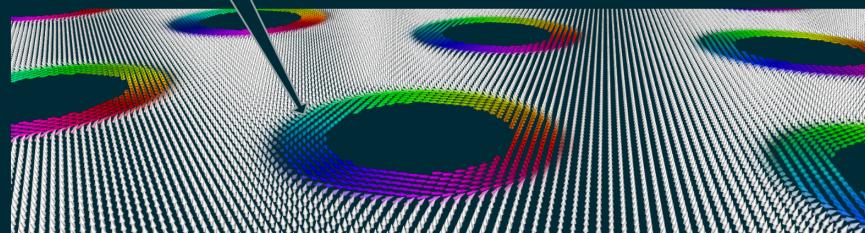
+



Rims are weakly coupled
with their neighbors

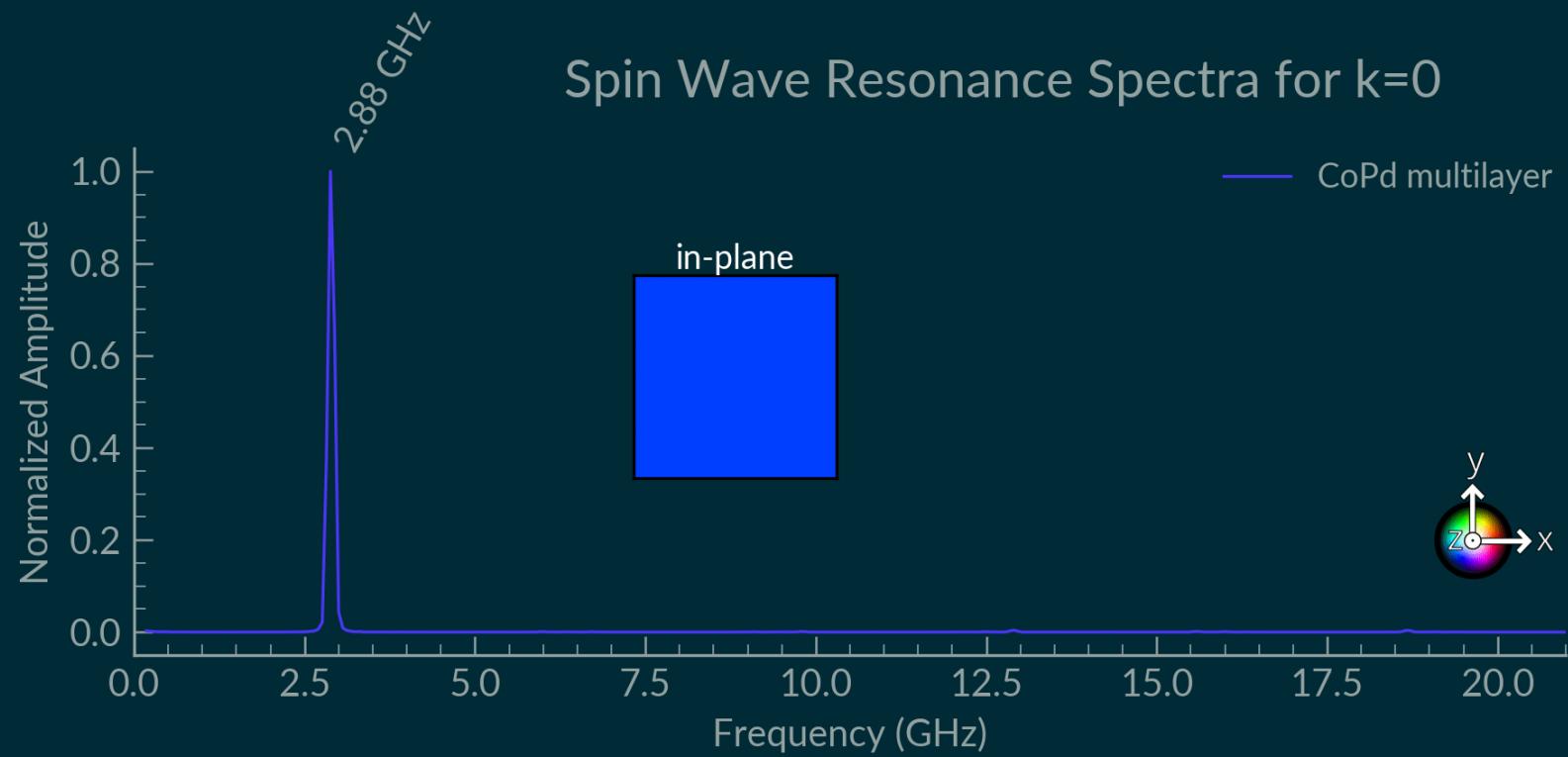
Antidot
Lattice

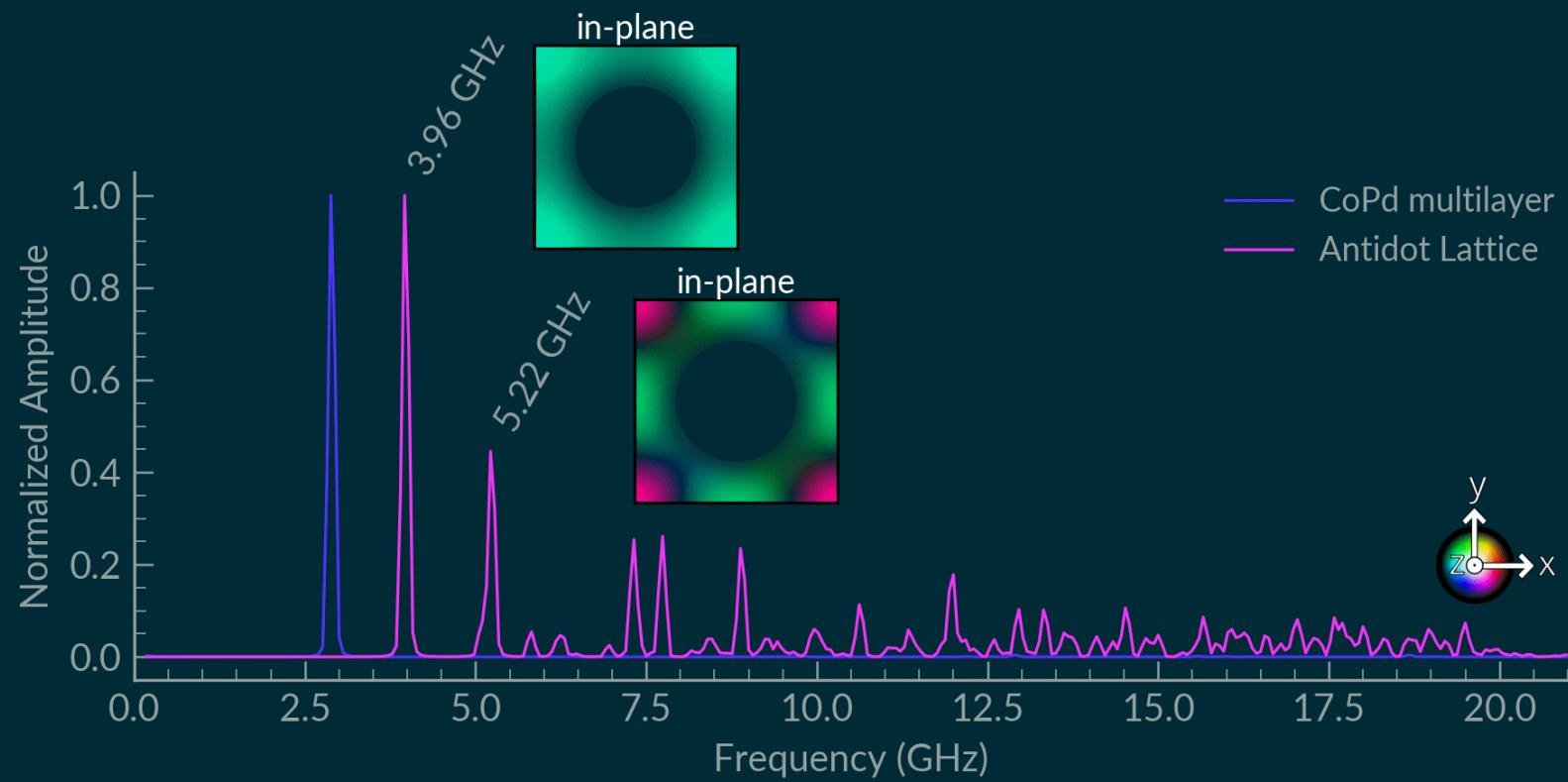
=

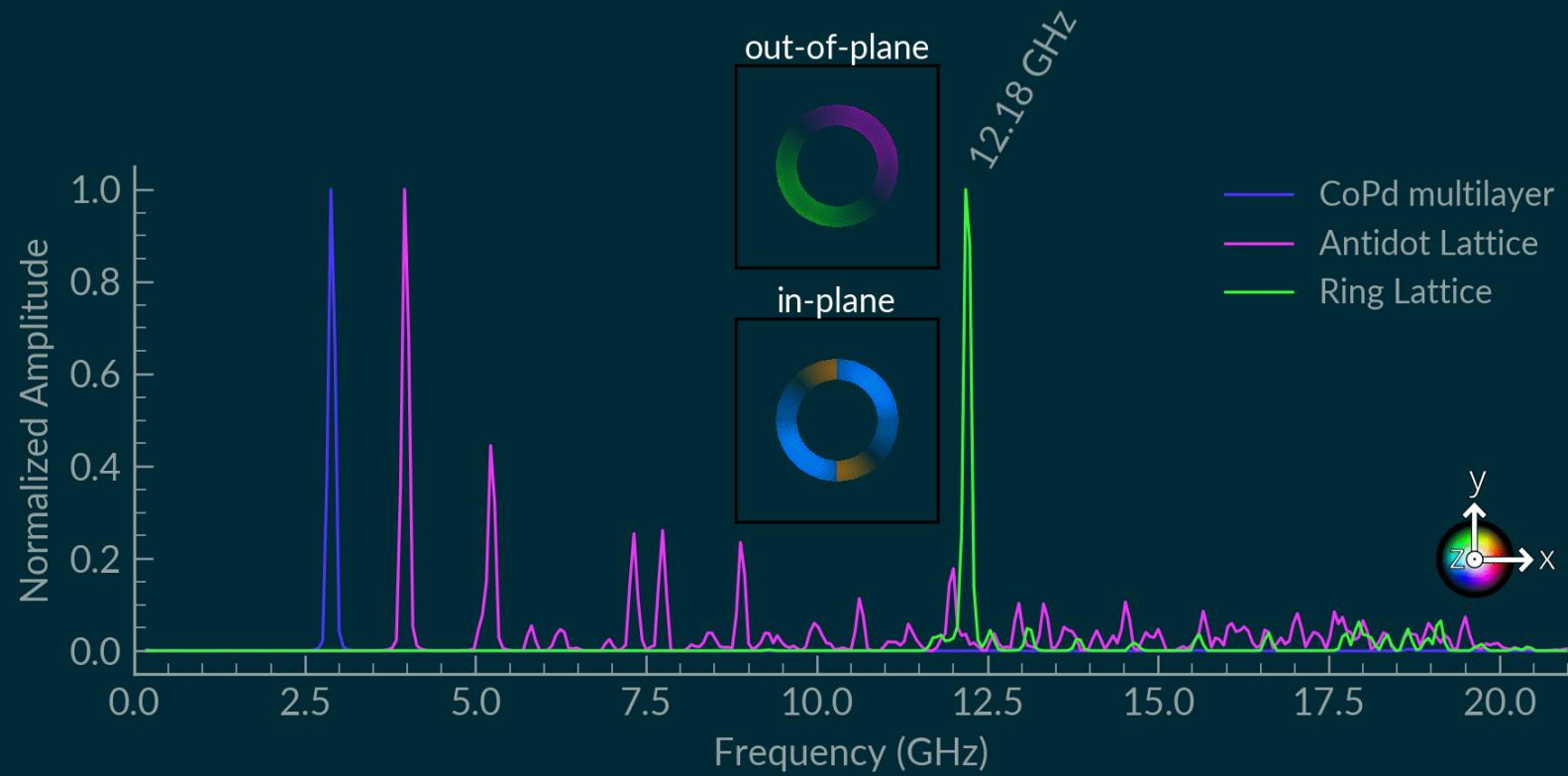


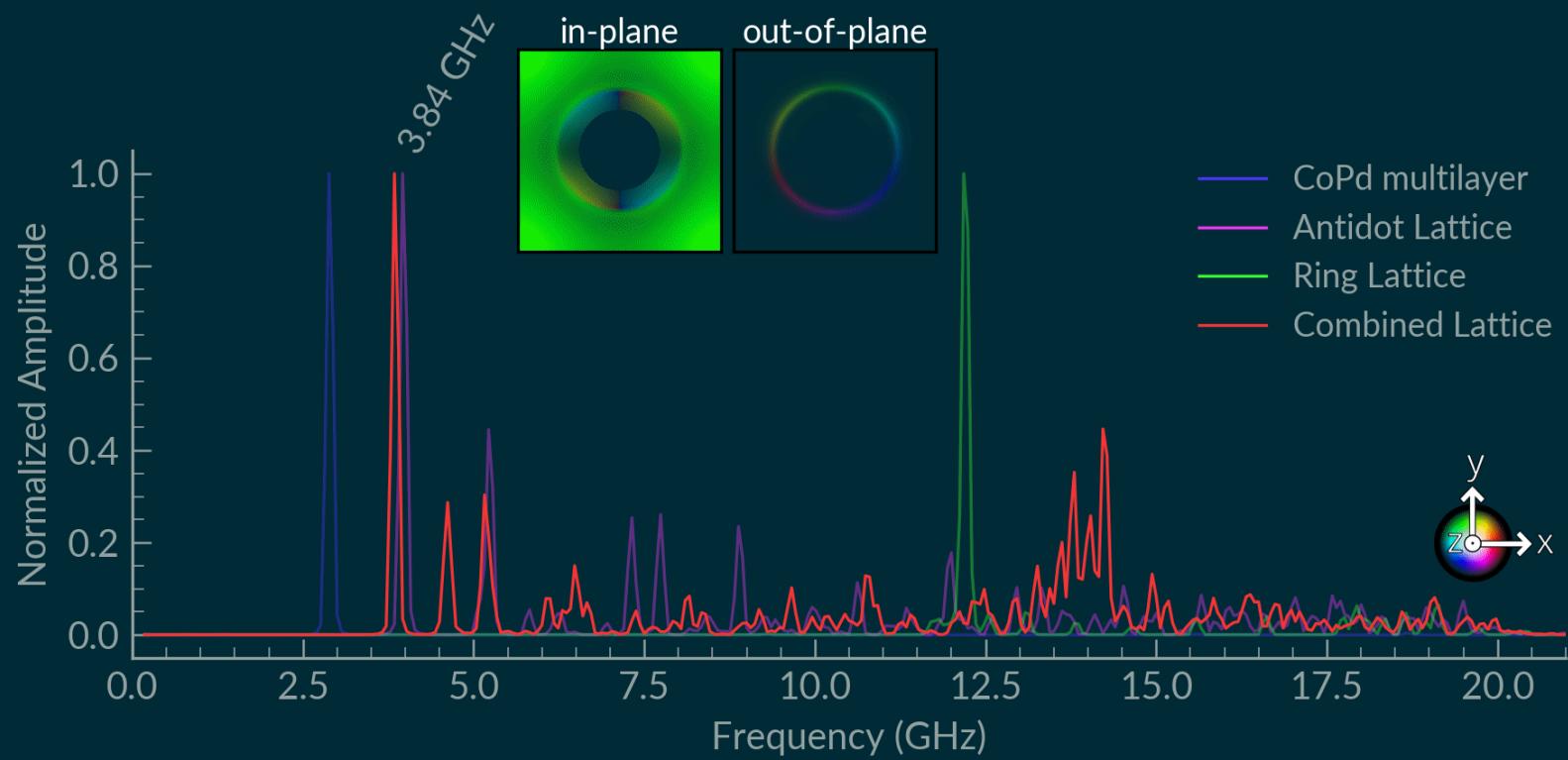
Combined
Lattice

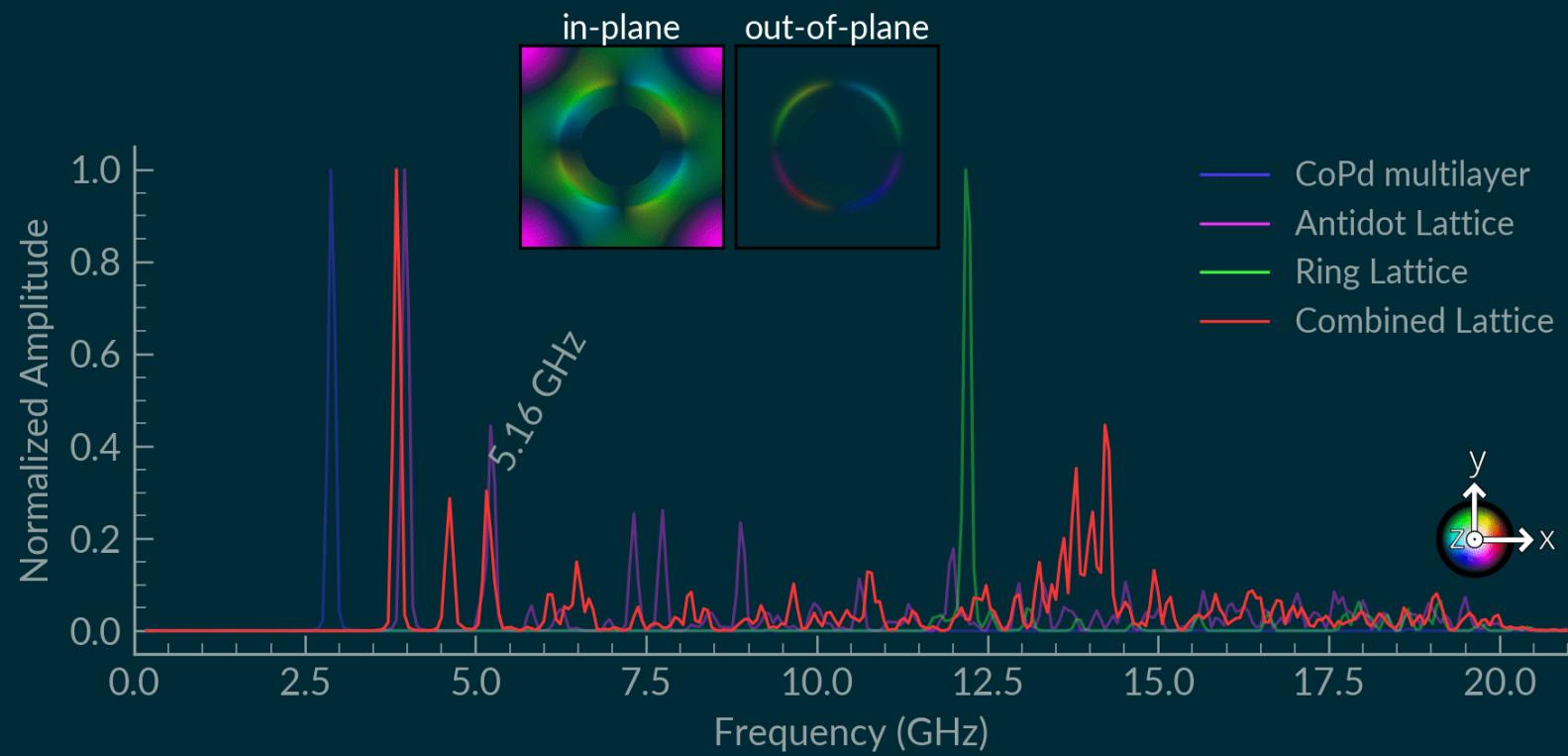
Spin Wave Resonance Spectra for $k=0$

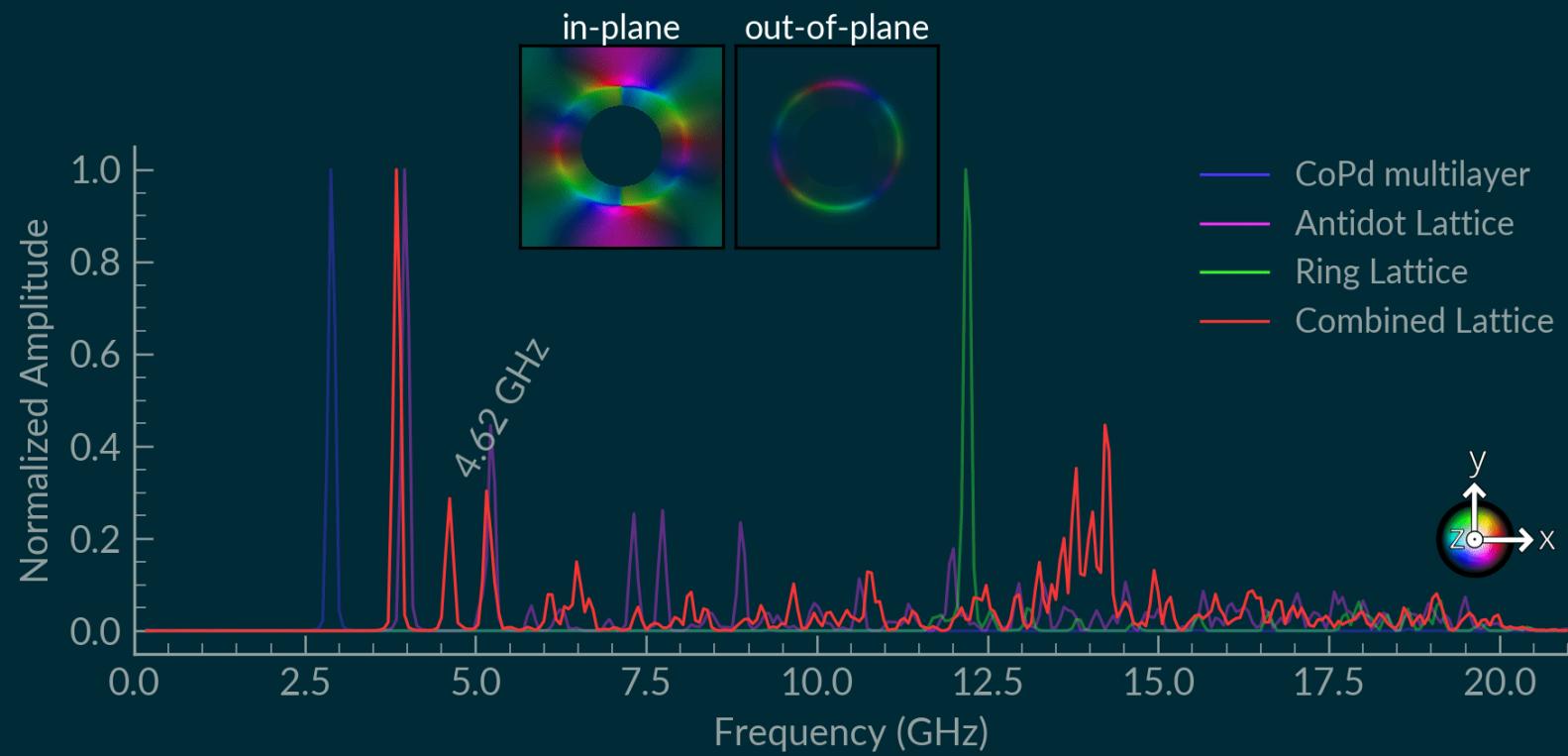


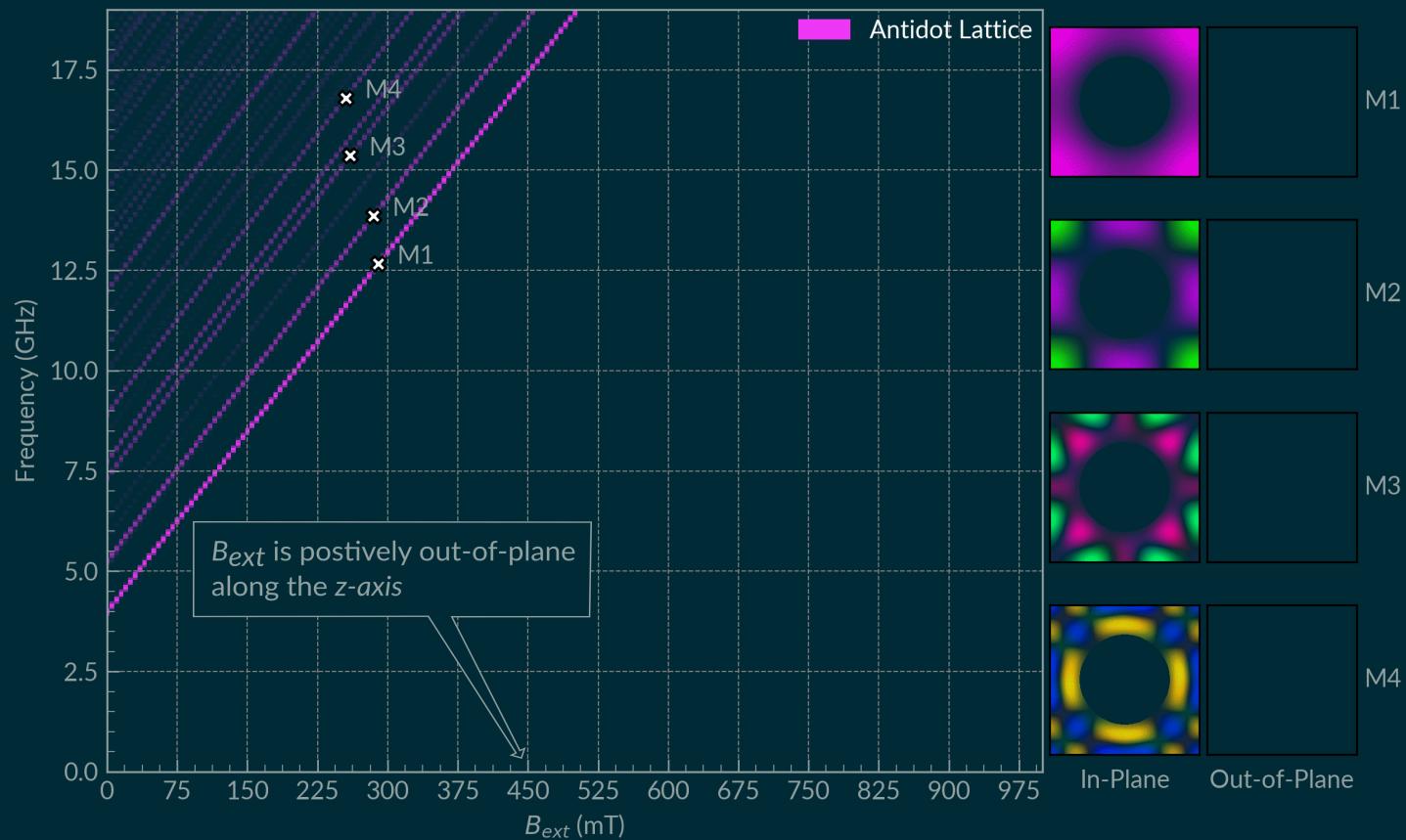


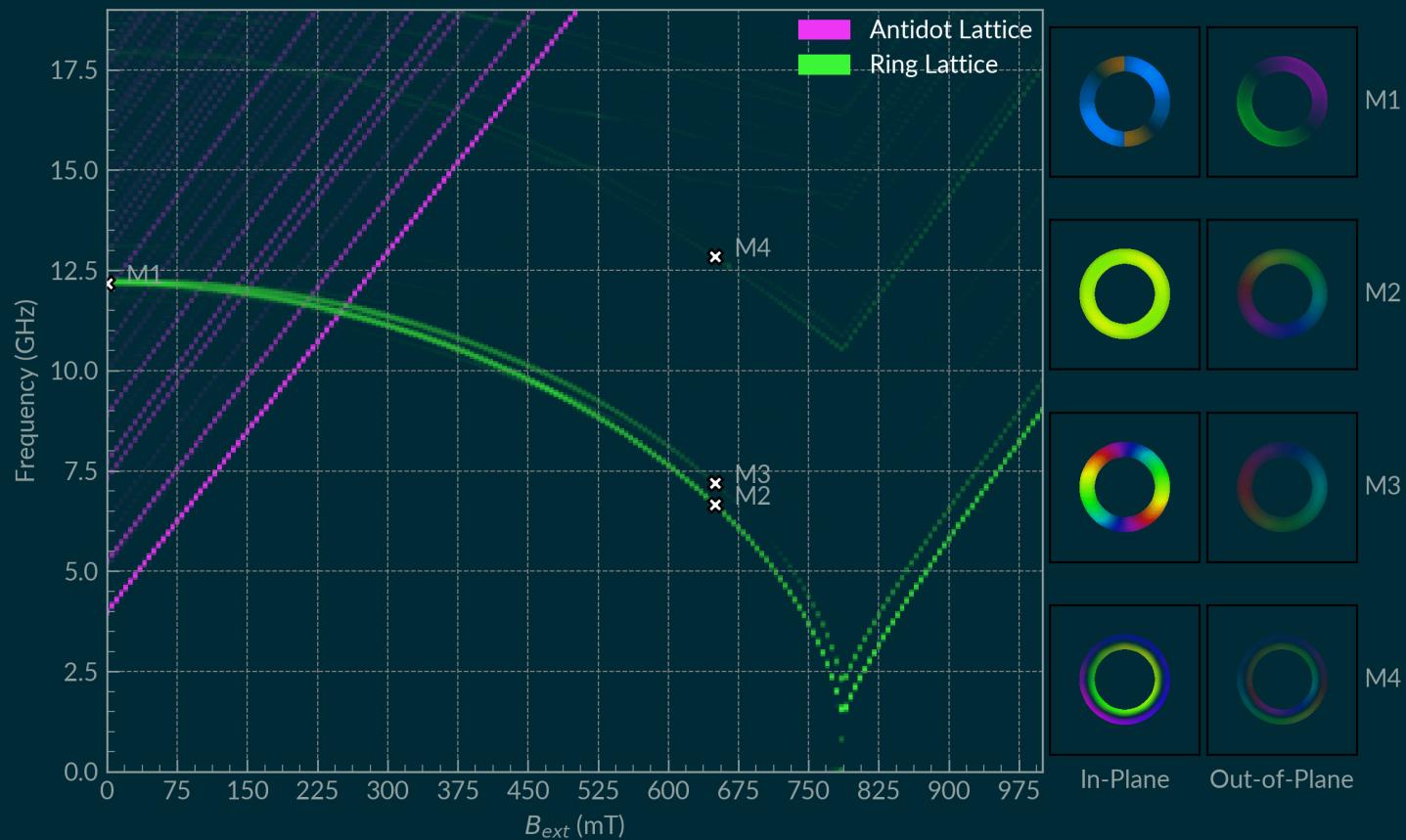


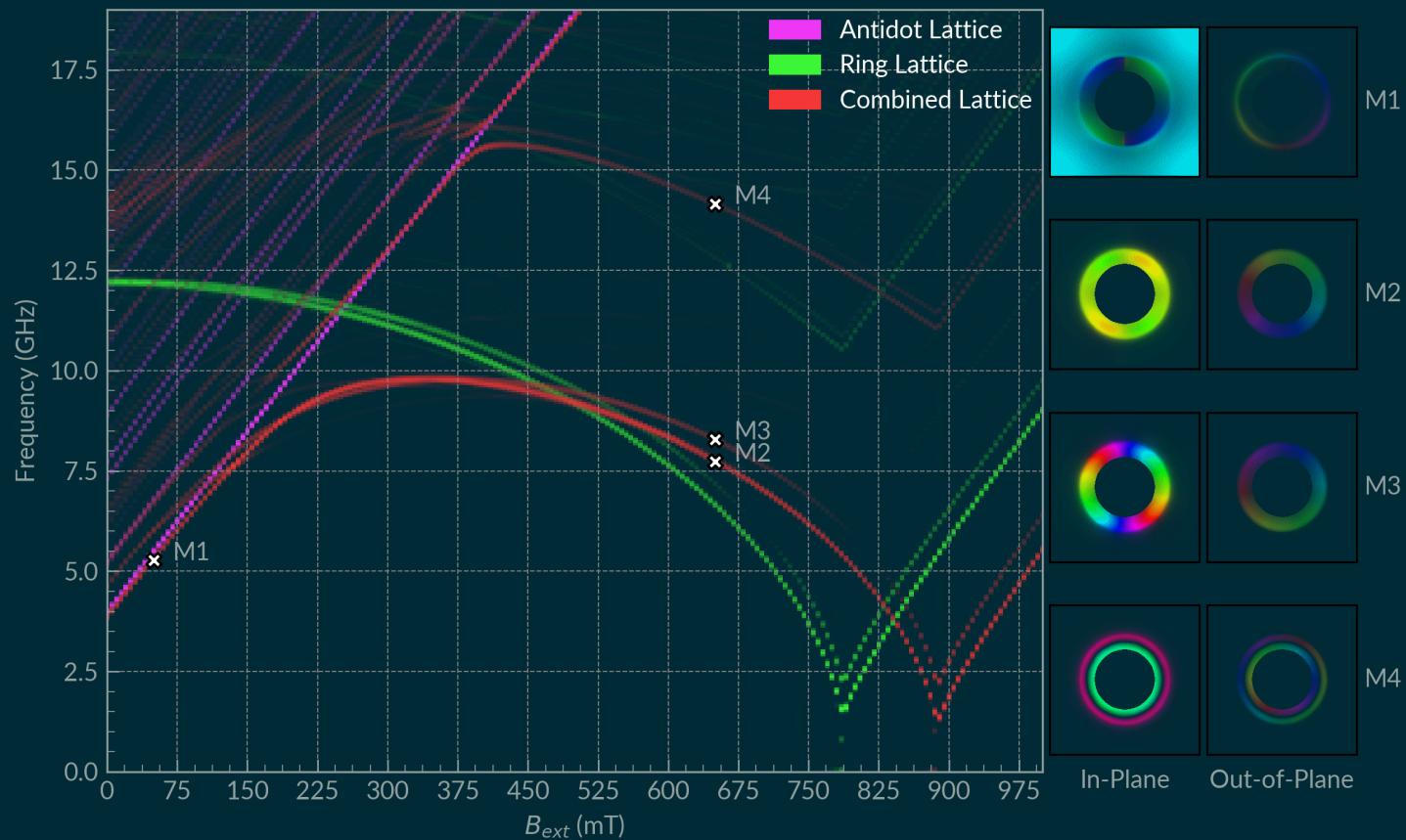


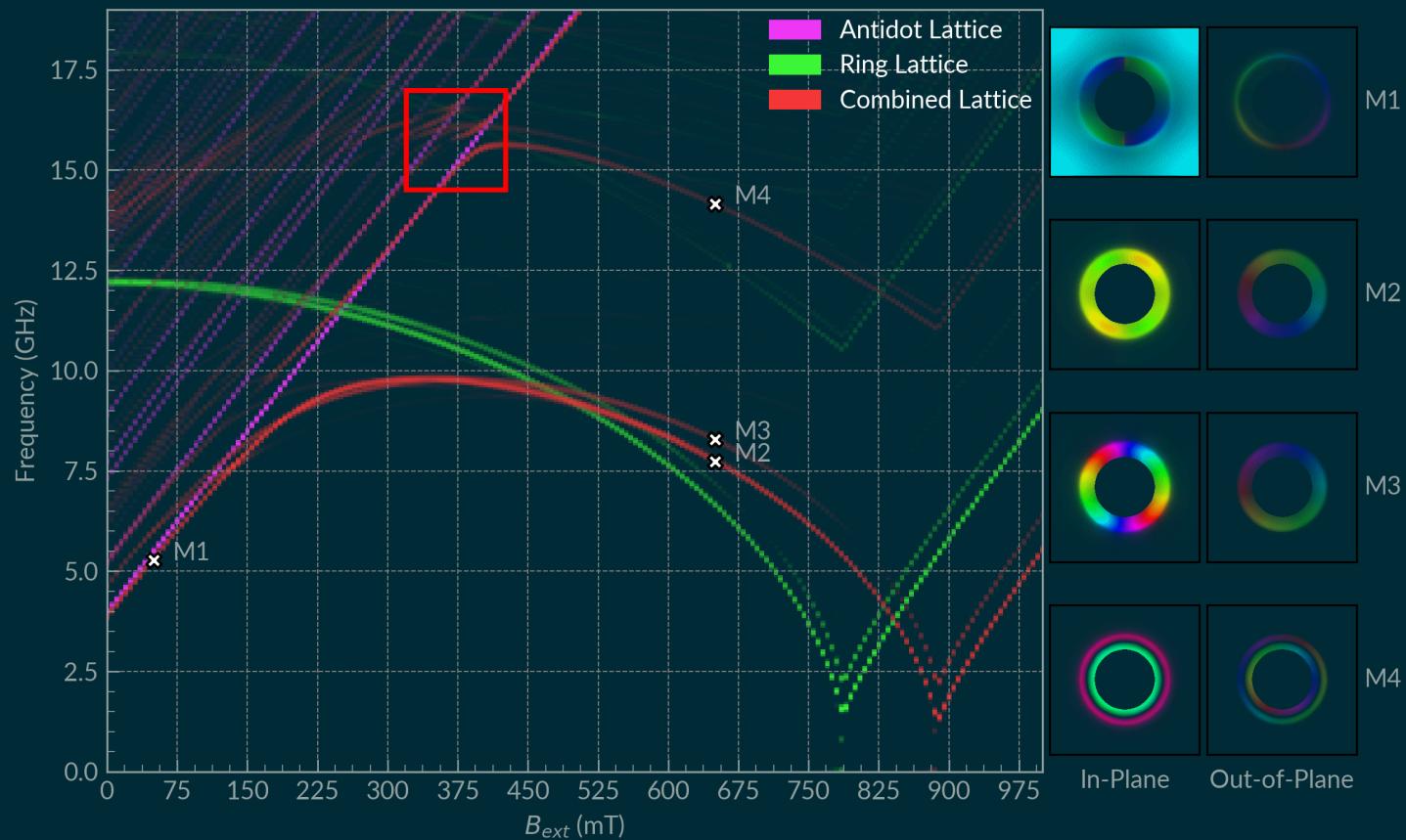




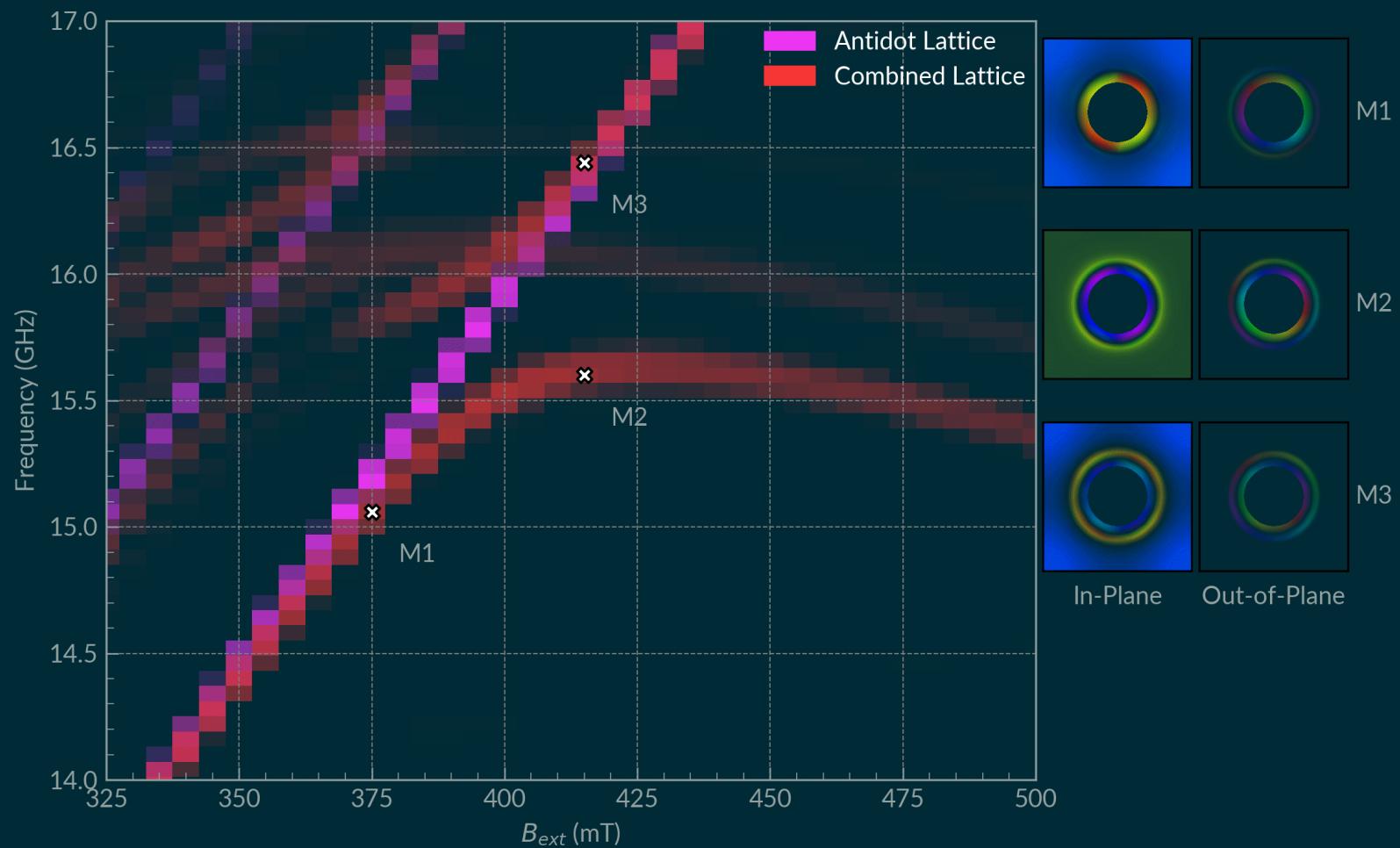








16.1



CONCLUSION

- We observe mode splitting for the ring and combined lattice

CONCLUSION

- We observe mode splitting for the ring and combined lattice
- Combining the antidot and ring lattices introduces new resonant modes

CONCLUSION

- We observe mode splitting for the ring and combined lattice
- Combining the antidot and ring lattices introduces new resonant modes
- Hybridization between bulk and rim modes

CONCLUSION

- We observe mode splitting for the ring and combined lattice
- Combining the antidot and ring lattices introduces new resonant modes
- Hybridization between bulk and rim modes
- Azimuthal modes with both azimuthal and radial nodes

CONCLUSION

- We observe mode splitting for the ring and combined lattice
- Combining the antidot and ring lattices introduces new resonant modes
- Hybridization between bulk and rim modes
- Azimuthal modes with both azimuthal and radial nodes

Presentation available at: solskymag2022.matmoa.xyz

