Meron Spin Textures in Momentum Space Spawning from Bound States in the Continuum

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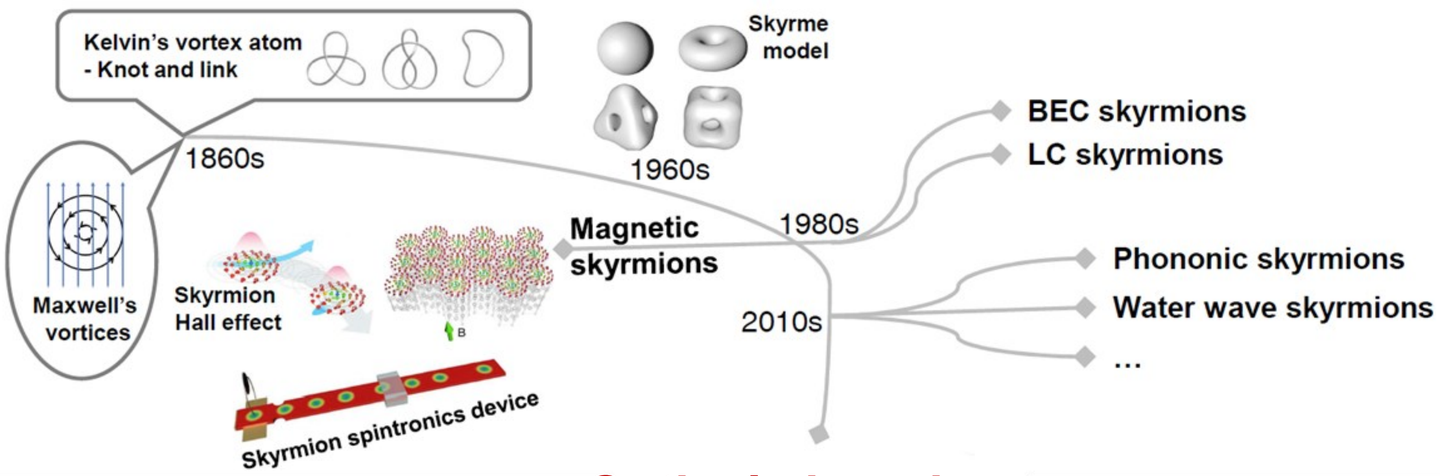
Optical skyrmions

History:



Optical skyrmions

Optical vector field with topological texture

Skyrmion number

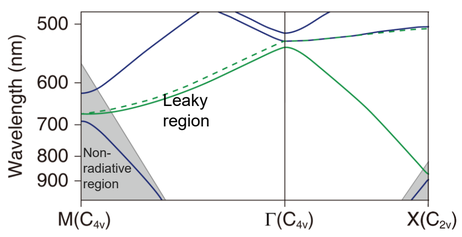
$$Q = \frac{1}{4\pi}\iint_{\Sigma} \mathbf{S}\cdot\left(\frac{\partial \mathbf{S}}{\partial x}\times\frac{\partial \mathbf{S}}{\partial y}\right)\mathrm{d}x\mathrm{d}y$$

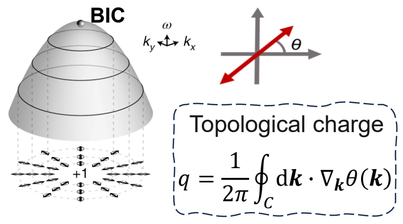
How to generate optical skyrmions?

Potential applications:
Sensing、 metrology、 information processing、 computing...

Meron spin texture spawning from BIC

Bound state in the continuum (BIC)

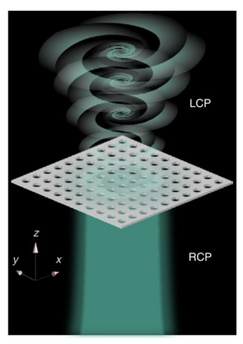




Topological charge

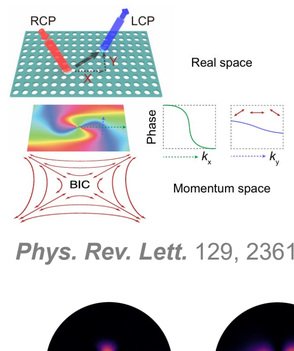
$$q = \frac{1}{2\pi}\oint_C \mathrm{d}\boldsymbol{k}\cdot\nabla_{\boldsymbol{k}}\theta(\boldsymbol{k})$$

BICs are powerful for **light field manipulation**



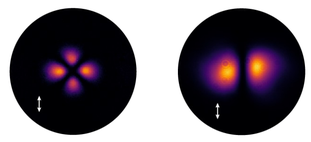
Nat. Photon. 14, 623 (2020)

Spin-to-vortex conversion



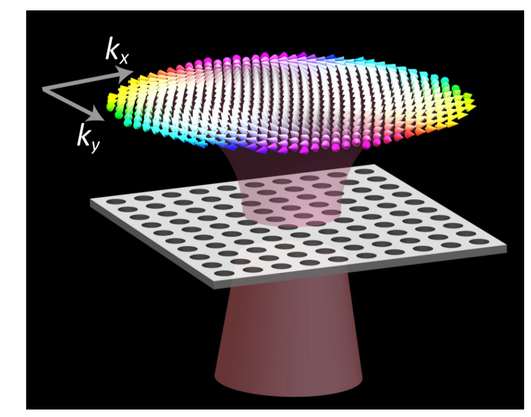
Spin-Hall effect

Phys. Rev. Lett. 129, 236101 (2022)



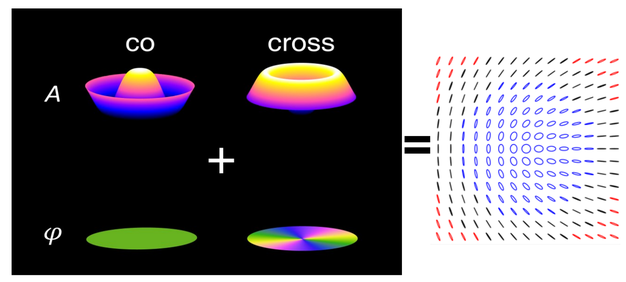
Phys. Rev. Lett. 134, 133802 (2025)

Vectorial vortex lasing



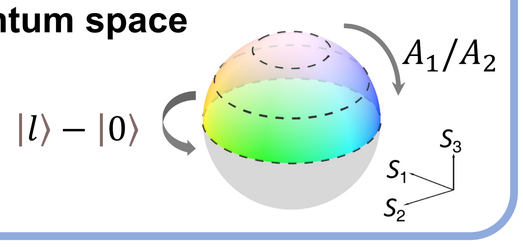
BIC-induced polarization conversion

Circularly polarized incidence



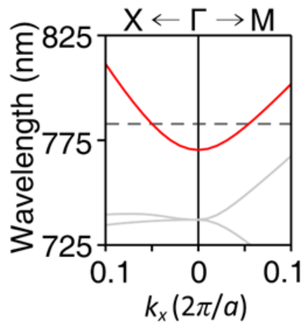
$$|E_{out}\rangle = A_1|0\rangle|\sigma_1\rangle + A_2|l\rangle|\sigma_2\rangle$$

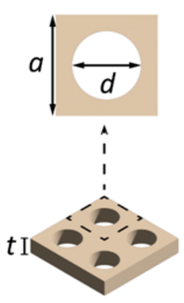
Momentum space

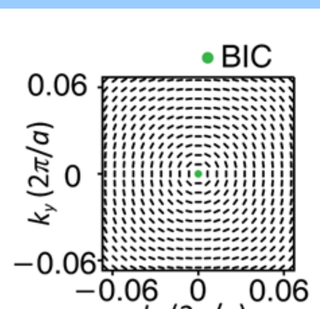


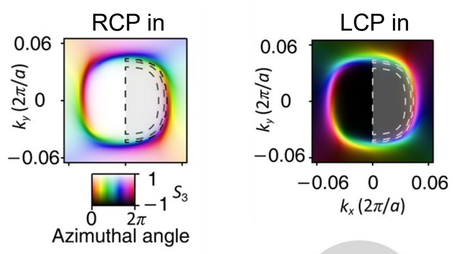
Requiring NO alignment in real space!

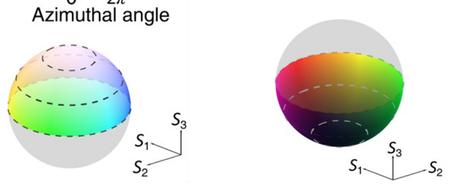
Realization of momentum-space meron









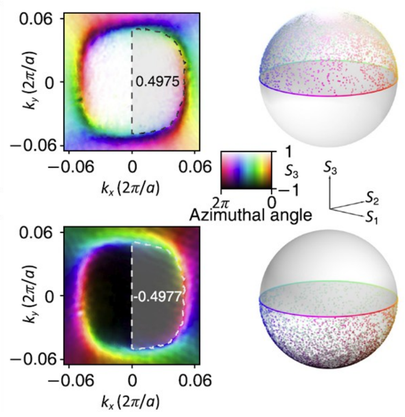


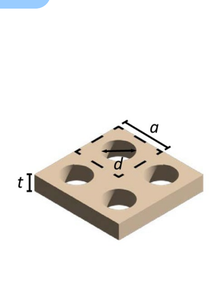
Skyrmion number Q	BIC topological charge q

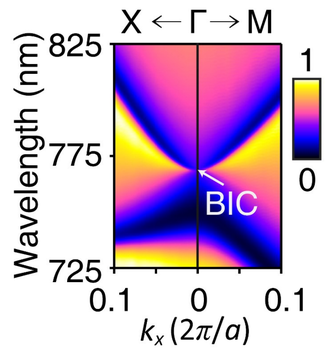
"$Q = \pm q$"

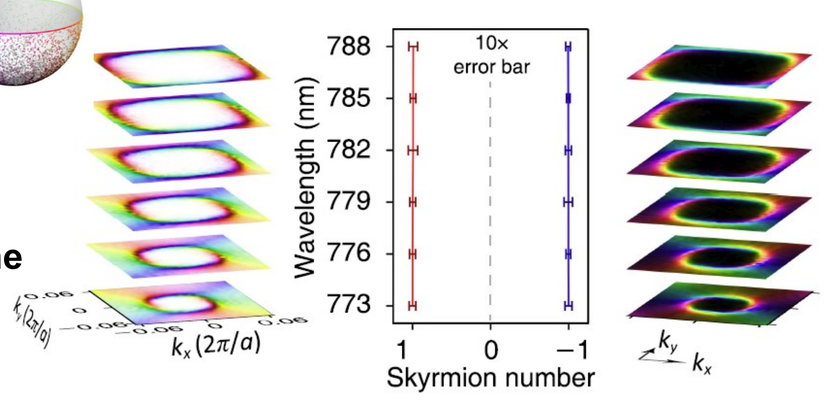
RCP incidence: $Q = +q$
LCP incidence: $Q = -q$

Switchable configurations









Merons evolve with the band configuration

Conclusion

1. Providing an easy, compact, and robust way to generate merons with muti-configurations across wavelengths

2. Revealing the physical link between BICs and merons in momentum space

Reference

1. Advan. Opt. Photon. **18**, 1 (2026)
2. Nat. Photonics **14**, 623 (2020)
3. Phys. Rev. Lett. **129**, 236101 (2022)
4. Phys. Rev. Lett. **134**, 133802 (2025)
5. Phys. Rev. Lett. **135**, 026203 (2025)