

*17º Congresso do Comité
Português da URSI, Lisboa*



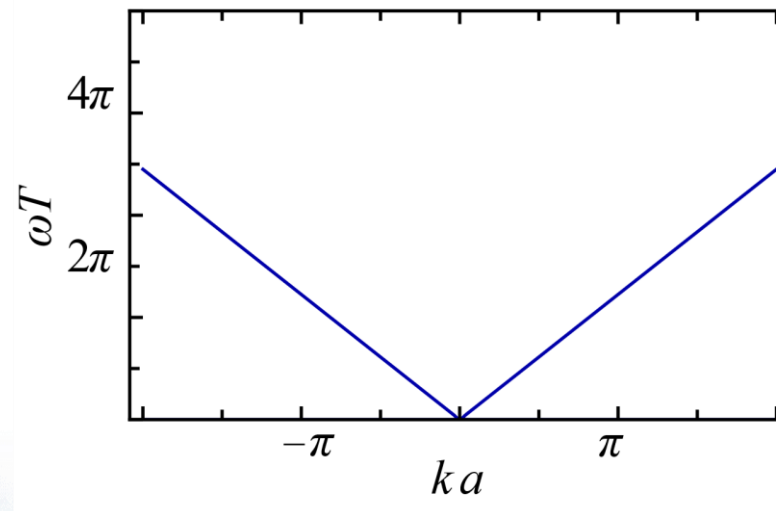
TÉCNICO
LISBOA

Electromagnetic Spacetime Crystals

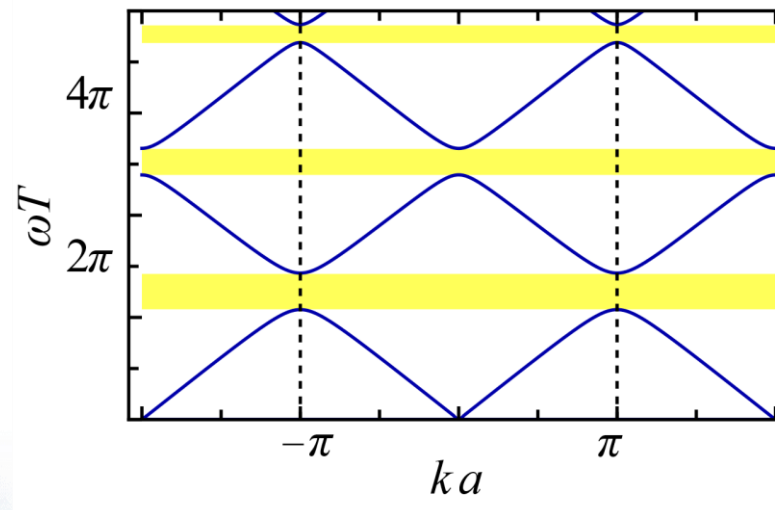
João Câmara Serra

Scientific Advisor: Prof. Mário G. Silveirinha

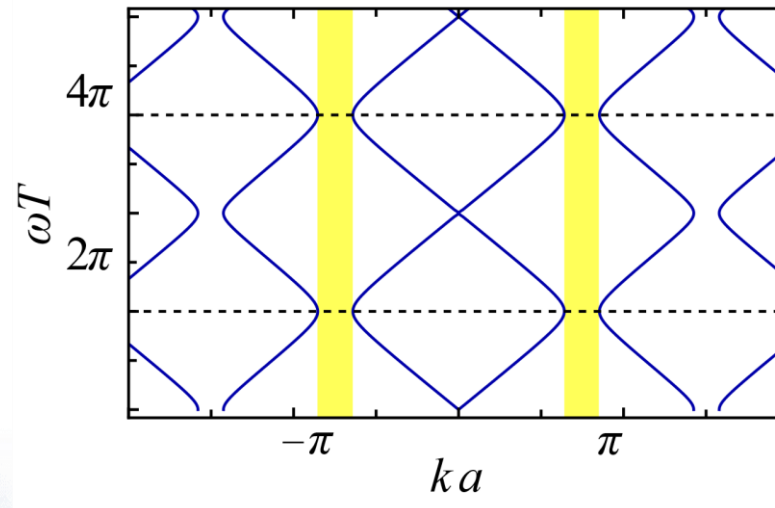
Electromagnetic Spacetime Crystals



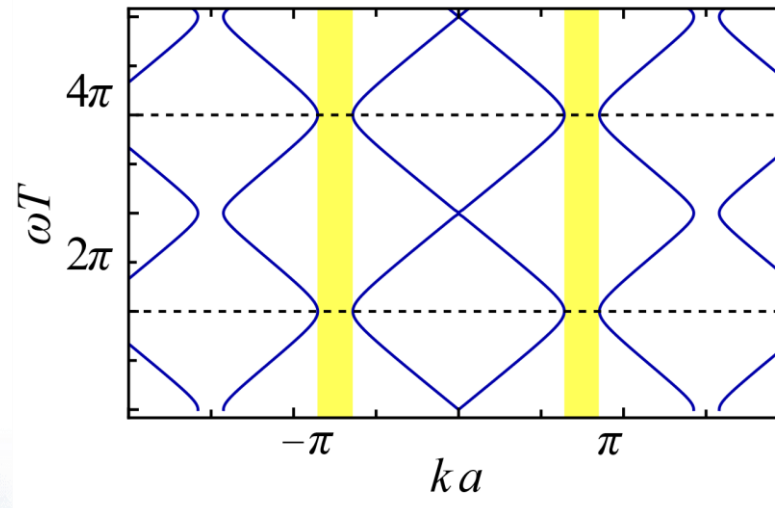
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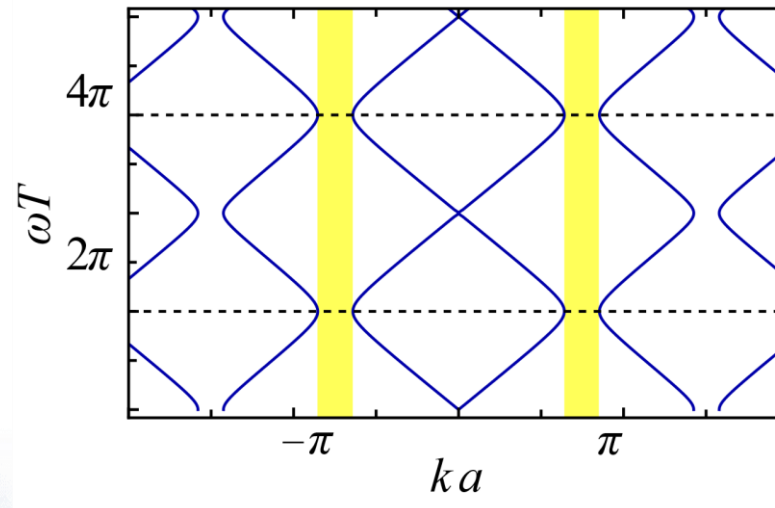
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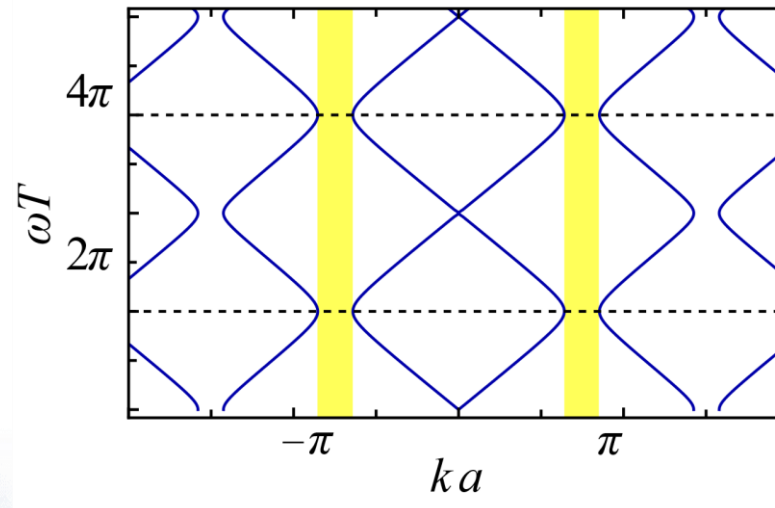
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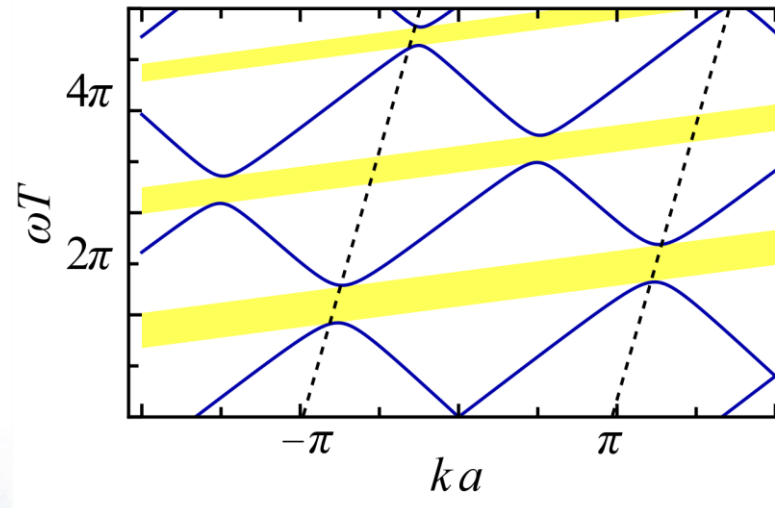
Electromagnetic Spacetime Crystals



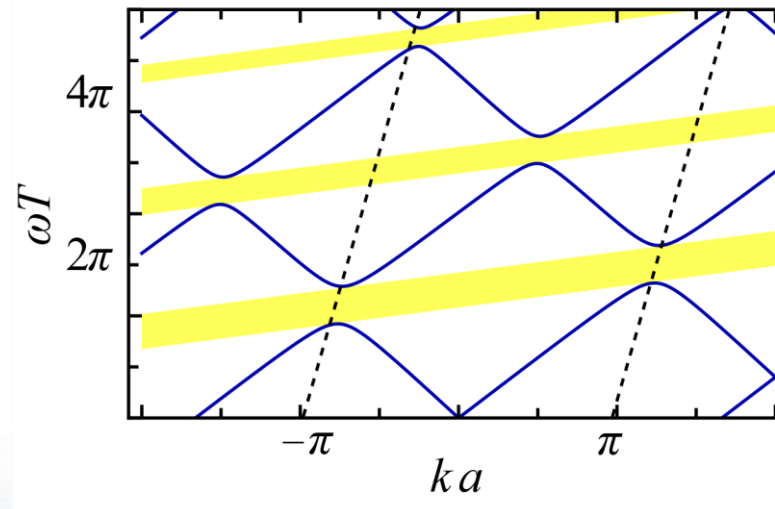
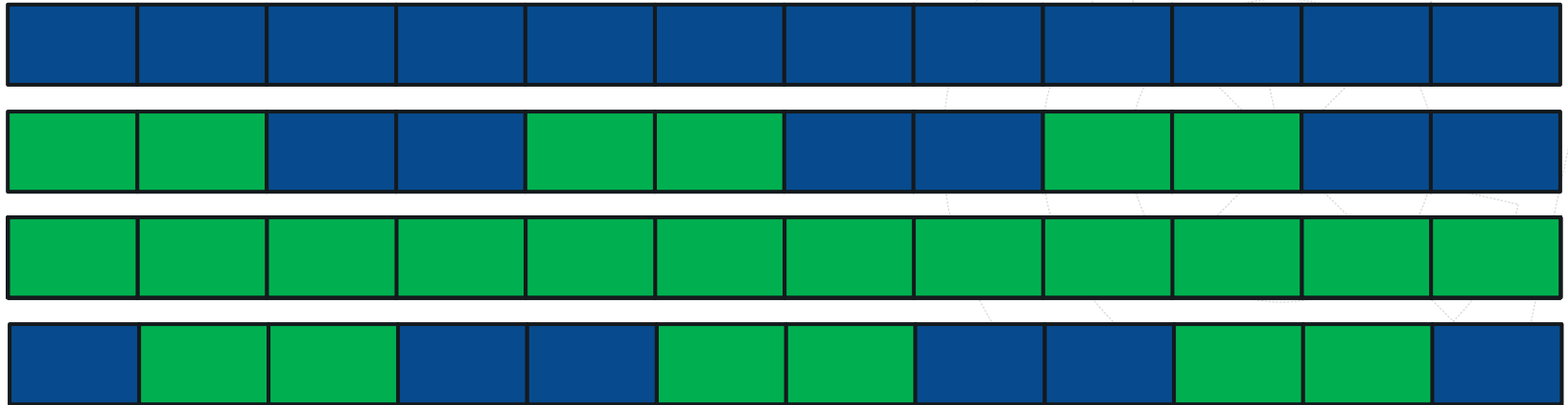
Electromagnetic Spacetime Crystals



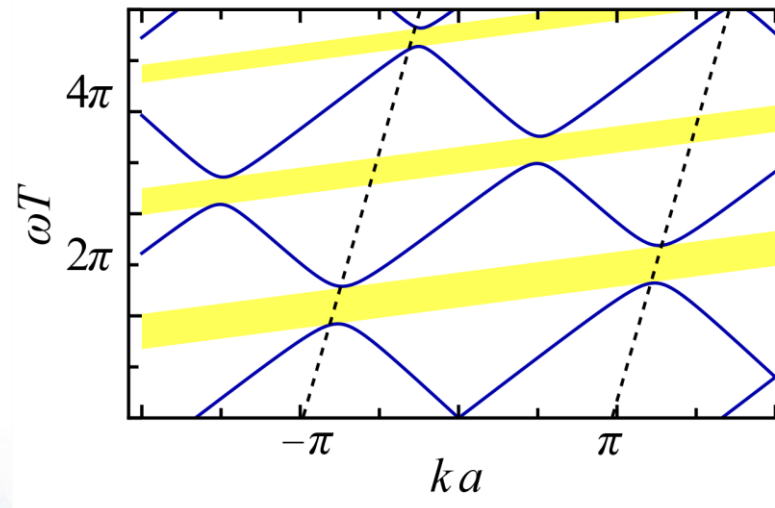
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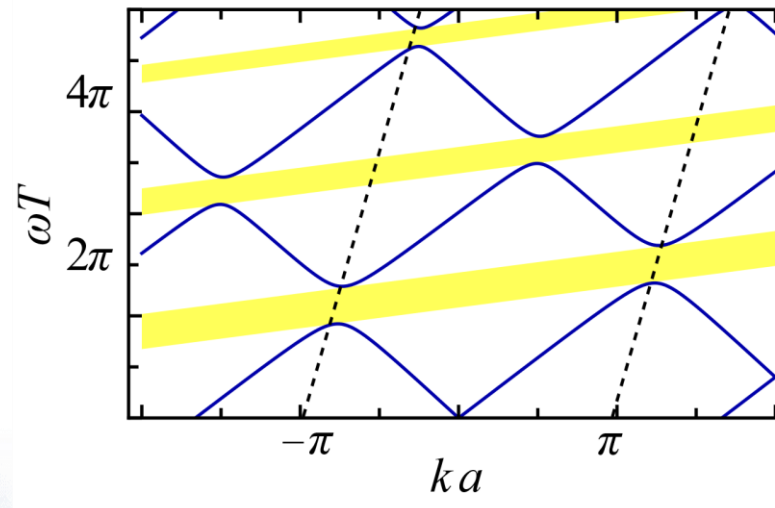
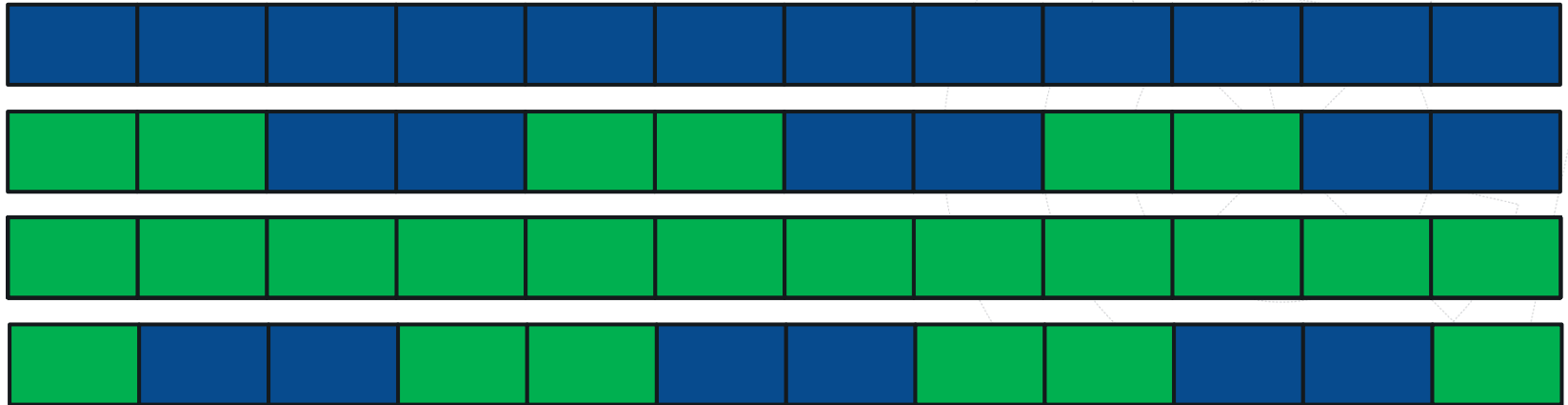
Electromagnetic Spacetime Crystals



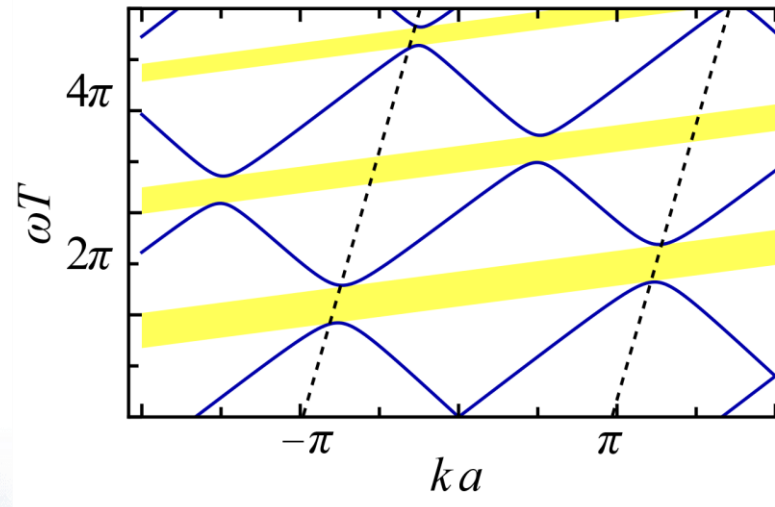
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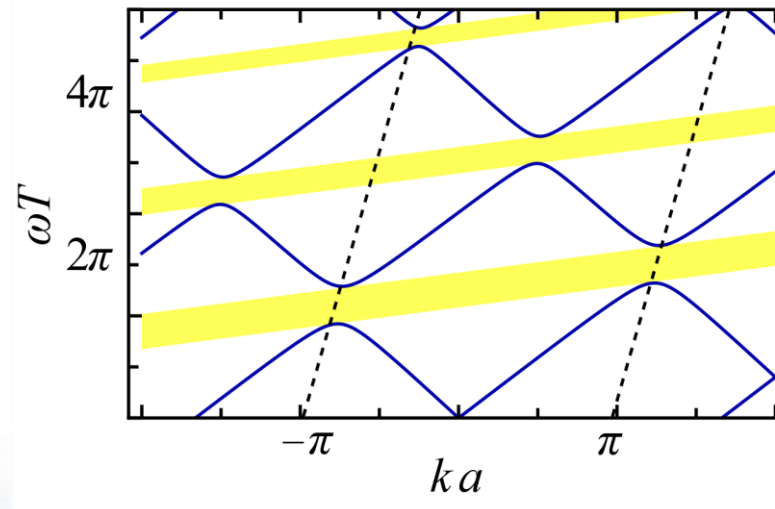
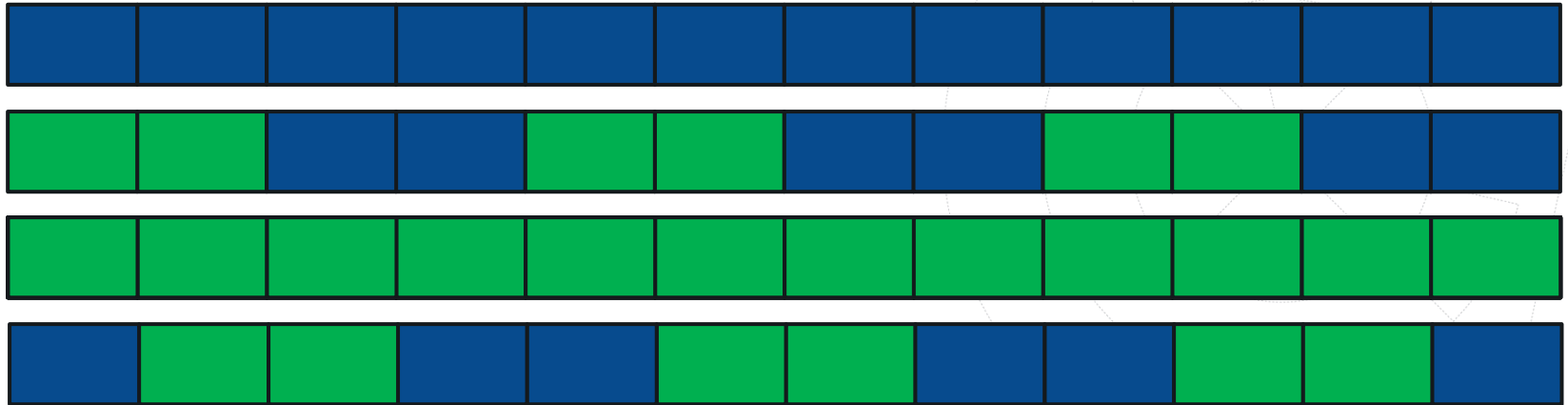
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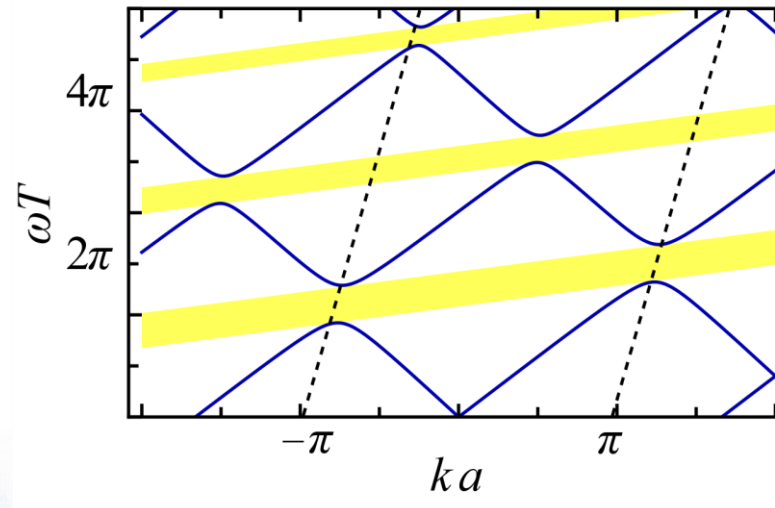
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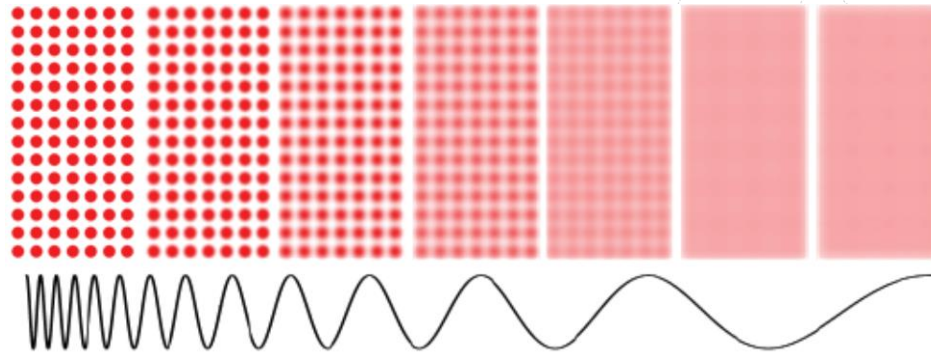
Electromagnetic Spacetime Crystals



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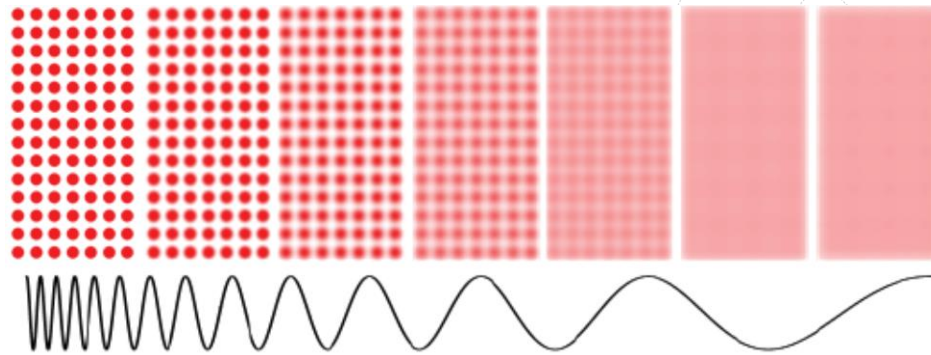


Homogenisation Theory



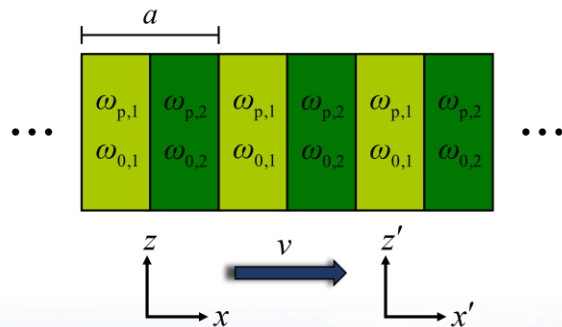
http://people.ee.duke.edu/~drsmith/metamaterials/metamaterials_homogenization.htm

Homogenisation Theory



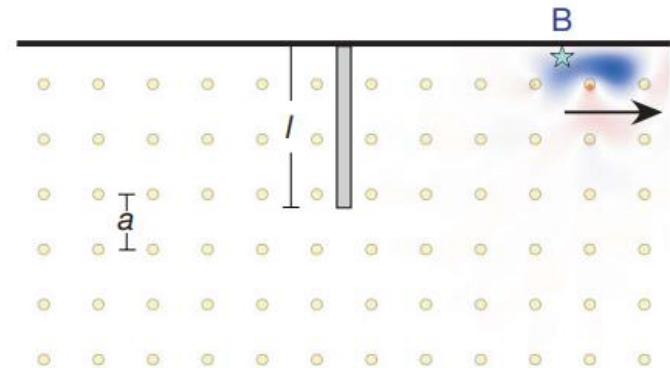
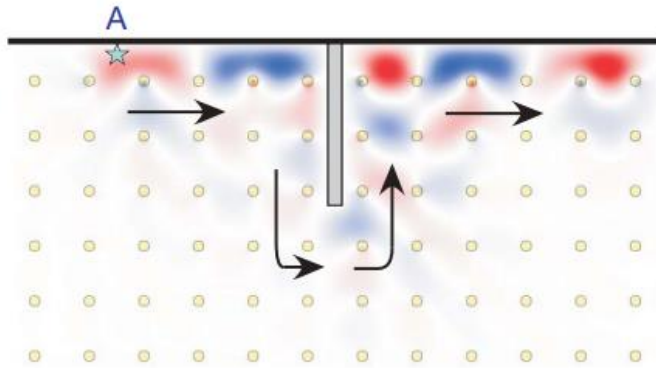
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J. C. Serra, M. G. Silveirinha, *Phys. Rev. B* **108**, 035119 (2023)



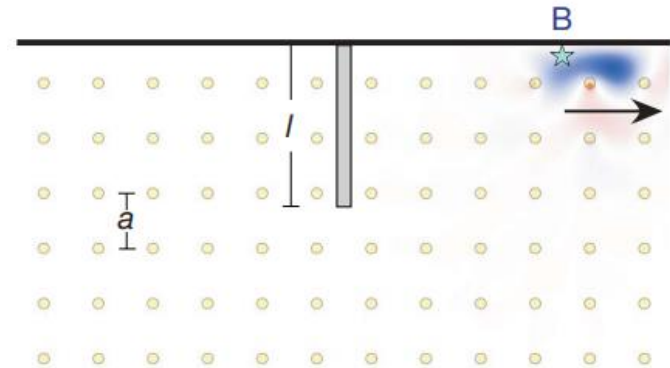
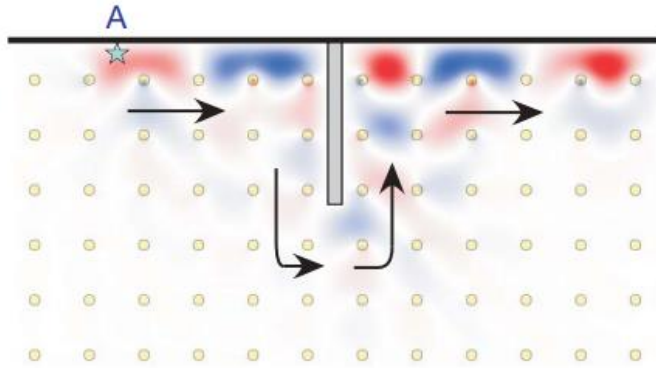
- **Gain and Loss**
- **Non-Foster Dispersion**
- **Quasi-Static Resonances**
- **Sensing Devices**

Topological Photonics



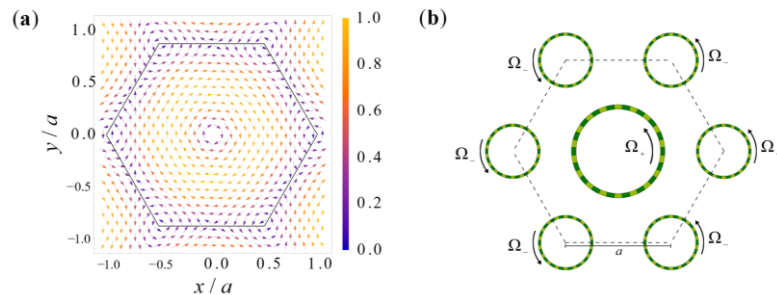
Z. Wang, Y. Chong, J. D. Joannopoulos, M. Soljačić, *Nature* **461**, 011037 (2009)

Topological Photonics



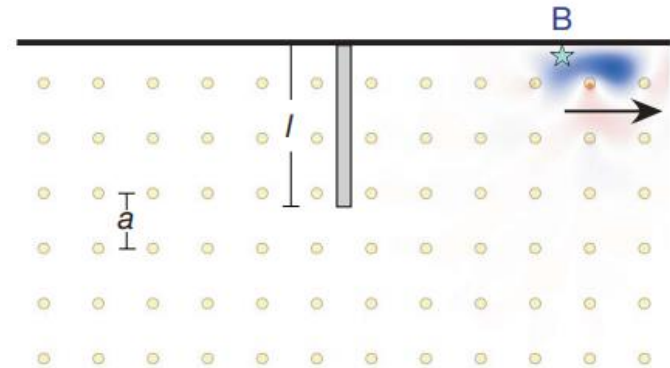
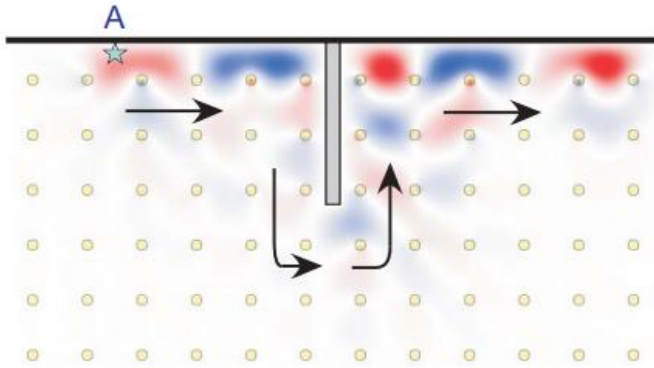
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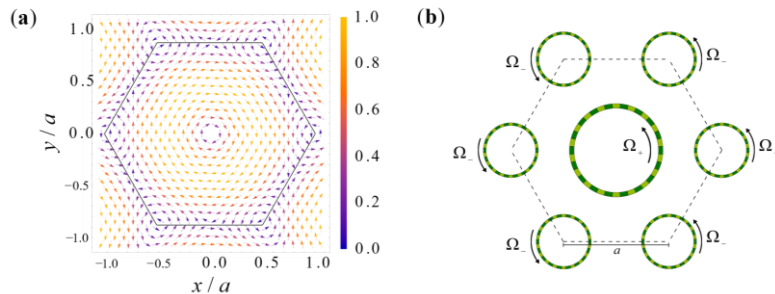
Robust Unidirectional Waveguides

Topological Photonics

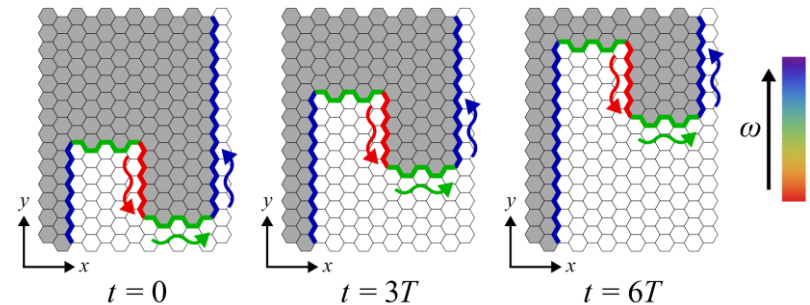


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J. C. Serra, M. G. Silveirinha, arXiv: 2309.15320



Robust Unidirectional Waveguides

Frequency Conversion Mechanism

Thank You