Project flyer

# An optical approach to next generation refrigeration

According to fundamental thermodynamics, using light as a refrigerant could allow new cooling technologies and a much better alternative for the presently prevailing mechanical heat pumps and their all-solid-state thermoelectric counterparts. Recent evidence shows that this is already possible with the right combination of innovations in lighting, photovoltaics and nanotechnologies. Addressing the challenges of the rapidly increasing global energy consumption on cooling and heating, OPTAGON aims to demonstrate and harness the fundamental phenomenon of electroluminescent cooling to develop the first thermophotonic coolers. This opens an new way to tackle the challenges of efficient solid-state cooling, all the way from cryogenic coolers to domestic heat pumps. We combine thin-film solar cell materials and light emitting diode structures with recently developed light extraction methods and emerging nanoengineering concepts using optical near-field effects to demonstrate the extraordinary prospects of thermophotonics. This creates a line of research, development, and innovation targeting a solid-state cooling revolution addressing the future industrial needs for efficient cryogenic solid -state cooling. OPTAGON combines synergies in theory, experiment and technology-development covering different fields from materials to photonics. The project partners, who are leaders in their respective fields, form a consortium that is uniquely positioned to achieve the ambitious objectives.

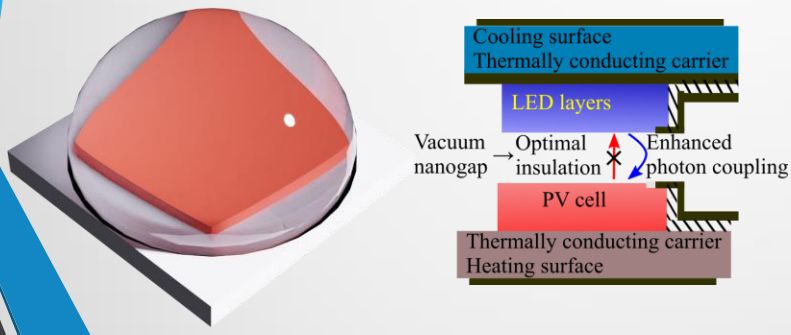


Figure: In OPTAGON conventional light emitting diodes (left) will transform into heat pumps.

In OPTAGON we investigate if reaching practical heat pump applications using thermophotonics is feasible with presently available and emerging technologies. To this end, we aim to demonstrate TPX cooling in an integrated device to validate its potential for next generation refrigeration.

**Key information:**
Five organisations,
three European countries
Duration: 09.2021 – 08.2025
Coordinator:
Dr. Jani Oksanen, Aalto University
Topic:
Future and emerging technologies (FET-OPEN)
Research and Innovation Action
Project web-page:
optagon-h2020.eu

WP1 Leader:
Dr. P-Olivier Chapuis, CNRS
WP2 Leader:
Prof. John Schermer, Radboud University
WP3 Leader:
Prof. Mika Prunnila, VTT

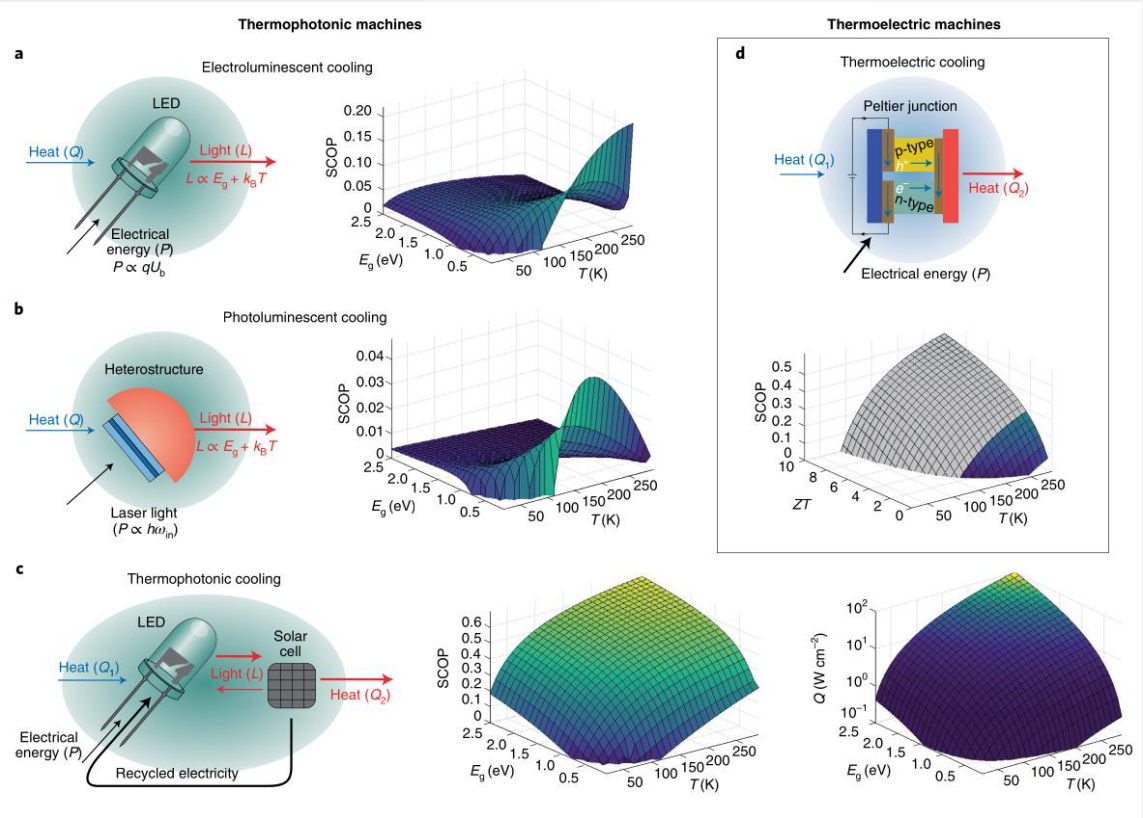


Figure: The basic principles and potential performance of electroluminescent, photoluminescent and thermophotonic refrigeration, and Peltier elements. Under ideal conditions the thermophotonic system can operate at very high system efficiencies and powers over a broad range of temperatures and material bandgaps. [T. Sadi, "Thermophotonic cooling with light-emitting diodes," Nat. Photonics (2020), doi: 10.1038/s41566-020-0600-6.]

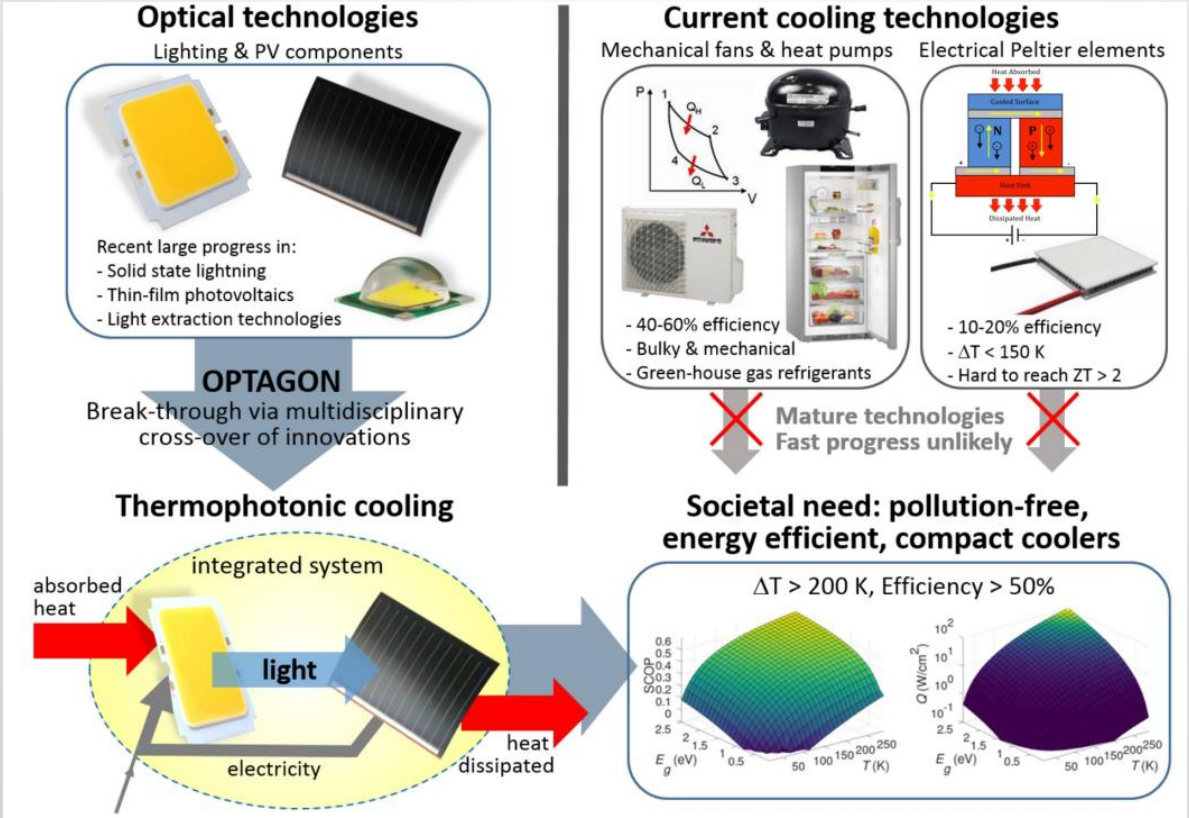


Figure: General overview of the project.

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