Physicists have discovered radical new properties in a nanomaterial which opens new possibilities for highly efficient thermophotovoltaic cells, which could one day harvest heat in the dark and turn it into electricity.

The research team from the Australian National University (ARC Centre of Excellence CUDOS) and the University of California Berkeley demonstrated a new artificial material, or metamaterial, that glows in an unusual way when heated.

The findings could drive a revolution in the development of cells which convert radiated heat into electricity, known as thermophotovoltaic cells.

"Thermophotovoltaic cells have the potential to be much more efficient than solar cells," said Dr Sergey Kruk from the ANU Research School of Physics and Engineering.

"Our metamaterial overcomes several obstacles and could help to unlock the potential of thermophotovoltaic cells."
visualized as a three-dimensional surface representing how electromagnetic radiation propagates in different directions. For natural materials, such as glass or crystals, the dispersion surfaces have simple forms, spherical or ellipsoidal.

The dispersion of the new metamaterial is drastically different and takes hyperbolic form. This arises from the material's remarkably strong interactions with the magnetic component of light.

The efficiency of thermovoltaic cells based on the metamaterial can be further improved if the emitter and the receiver have just a nanoscopic gap between them. In this configuration, radiative heat transfer between them can be more than ten times more efficient than between conventional materials.


Provided by Australian National University