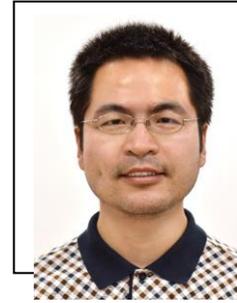


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Biography

Ji-Ping Huang received BSc degree in Physics from the Suzhou University in 1998, and PhD degree from the Department of Physics, The Chinese University of Hong Kong in 2003. He is currently a professor in the Department of Physics, Fudan University, Shanghai, China. He has published more than 150 journal papers. His research interests cover mainly heat conduction and thermal metamaterials.

Thermal metamaterials: macroscopic thermal diode and energy-free thermostat

It is known that humans are faced with a global energy crisis, namely, an increasing shortage of nonrenewable energy resources, such as coal, petroleum, and natural gas. However, much of the energy generated from nonrenewable energy resources is changed into thermal energy, which is hard for humans to re-use freely. Therefore, it is meaningful and challenging to manipulate the flow of heat (thermal energy). Here, by establishing temperature-dependent transformation thermotics for treating materials whose conductivity depends on temperature, we show evidence for switchable thermal cloaking and a macroscopic thermal diode based on the cloaking. Meanwhile, we also establish a theory of temperature trapping, and then propose and fabricate a new thermostat for maintaining constant temperatures (within a temperature gradient in the environment) without the need of consuming additional energy. These results suggest that our theory could be adopted for achieving novel macroscopic heat management by using thermal metamaterials, and it could provide new guidance for energy saving.