

# Caloric Effects in Magnetic Materials

Hari Srikanth

Functional Materials Laboratory, Physics Department, University of South Florida, USA



Caloric effects in magnetic materials have generated a lot of interest in the scientific community over the years owing to their impact on technological applications such as refrigeration, waste heat recovery for power generation, thermoelectric and spintronic devices. There are many caloric effects generally related to the coupling of ferroic order parameters to external magnetic fields and phase transitions or generation and manipulation of pure spin currents through thermal gradients. In this talk we would focus on two such caloric effects namely the magnetocaloric effect (MCE) and spin caloric effect (SCE) and present recent advances on these topics made in our Functional Materials Laboratory.

We demonstrate that it is possible to combine thermoelectric and magnetocaloric properties for dual functional refrigeration in  $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$  semiconducting clathrates. By forming composites with  $\text{EuO}$  we can tune the optimal MCE characteristics, operating temperature range and refrigerant capacity. In the other area of spin caloritronics, we emphasize the important role of magnetic anisotropy and interface coupling between the magnetic insulator (YIG) and metal (Pt) layers through systematic investigations of the anisotropy and spin Seebeck effect (SSE). We discuss the exciting possibility of improving the spin mixing conductance and enhancing SSE through appropriate choice of buffer layers between YIG and Pt. Overall, we will present an overview based on our research how these caloric effects can lead to new and improved thermomagnetic devices.

## About the speaker

**Hari Srikanth** is a Professor of Physics at the University of South Florida in Tampa, FL. He received his Ph.D. in experimental condensed matter physics from the Indian Institute of Science. After postdoctoral research for several years, Hari joined USF in 2000 and established the Functional Materials Laboratory. His research spans a wide range of topics including magnetization dynamics in nanostructures, applications of magnetic nanoparticles in nanomedicine and RF devices, magnetic refrigerant materials, spin calorics, microwave materials and complex oxides with competing magnetic phases. He has around 250 publications and has given over 150 invited talks around the world. Hari has developed a short tutorial on nanomagnetism, enjoys delivering pedagogical lectures for a broad audience and especially interacting with students and early career researchers. Hari is a *Fellow of the American Physical Society*, with the citation mentioning his contributions in the field of nanomagnetism, and a *Senior Member of IEEE*. He is currently an Associate Editor for *Journal of Applied Physics*. Hari has been closely involved with the MMM and INTERMAG conferences for more than 15 years serving as Publication Editor, Publication Chair and on program committees. He has been a short term visiting professor in Slovak Academy of Sciences (Kosice), Basque Center for Materials (Bilbao), Indian Institute of Technology (Bombay), Indian Institute of Science (Bangalore) and Immanuel Kant Baltic Federal University (Kaliningrad).