



## PHYSICS COLLOQUIUM:

# Thermoelectric Performance of Two-Dimensional Materials

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### Abstract

Applications of the thermoelectric (TE) effect require development of materials with high conversion efficiencies between heat and electric energies. Two-dimensional crystal structures which have emerged as a promising class of materials in recent years are also studied in terms of their TE properties. TE conversion efficiency of a material is larger when the correlation between its electronic and thermal conductivities is weak. It is known that TE efficiency is increased in low-dimensional systems such as thin films and nanowires. Indeed, computational and experimental studies reveal the potential of various two-dimensional materials as efficient TE converters. It is expected that these materials can be used in micro-scale TE cooling applications.

In this talk, I will present the ballistic TE transport properties of two-dimensional transition metal dichalcogenides (MX<sub>2</sub> crystals where M = Cr, Mo, W, Ti, Zr, Hf; and X = O, S, Se, Te) based on Landauer-Büttiker formalism and ab initio calculations [1].

[1] G. Özbal, R. T. Senger, C. Sevik, H. Sevinçli. Ballistic Thermoelectric Properties of Monolayer Semiconducting Transition Metal Dichalcogenides and Oxides Physical Review B 100, 085415 (2019)

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### About the Speaker

Tugrul Senger received his B.Sc., M.Sc., and Ph.D. degrees from Bilkent University, Ankara, Turkey. He was a postdoctoral research fellow at Emory University and then an assistant professor at Bilkent University before he joined Izmir Institute of Technology in 2009. Currently he is a full professor and he has served as Dean of the Graduate School and Head of the Physics Department at Izmir Institute of Technology. His research interests are in the fields of theoretical condensed matter physics and computational materials science, including electronic, mechanical and optoelectronic properties of low dimensional systems and two-dimensional materials. Dr. Senger is currently a Fulbright visiting scholar at UC Davis.

