Electrons that conduct electricity but (almost) not heat in metal

Prof. Junqiao Wu, Materials Science and Engineering, UC Berkeley

In conventional metals, itinerant electrons carry both charge and heat. As a consequence, electrical conductivity and the electronic contribution to thermal conductivity are typically proportional to each other, known as the Wiedemann-Franz law that is robust in all conventional metals. We found a large violation of this law near the insulator-metal phase transition in metallic vanadium dioxide (VO2). In the metallic phase of VO2, the electronic contribution to thermal conductivity accounts to only 10% of what would be expected from the Wiedemann-Franz law. The results are explained in terms of independent propagation of charge and heat in a strongly correlated electron system, where the electrons move in unison in a new, non-quasiparticle mode, in stark contrast to the conventional Drude mode. (Lee et al, Science, Vol. 355, Issue 6323, pp. 371-374 (2017)).

About the speaker: http://www.mse.berkeley.edu/~jwu/junqiaowu.html