SEMINAR NOTICE

Department of Physics and Engineering Physics
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SPEAKER: Dr. Zhi-Wei Wang, Post-Doc
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TOPIC: ***Thermodynamics of ordinary surface and energy definition in dynamical spacetimes***

DATE: Tuesday April 5th, 2022

TIME: 3:30-4:30 p.m.

PLACE:

ABSTRACT:

In the 1970s, Hawking and colleagues showed that black hole horizons behave thermodynamically for stationary scenarios. More recently, ordinary surfaces, away from horizons, were conjectured to behave thermodynamically, forming the key assumption in the emergent gravity program. With such a thermodynamic assumption, the full Einstein field equations were derived. To test whether this thermodynamic assumption is consistent with canonical general relativity, we generalized the original analysis of Bardeen, Carter and Hawking to ordinary surfaces (instead of horizons) in the stationary setting. Our key result from this work is that ordinary surfaces *cannot* generally obey the first law of thermodynamics. Therefore, the thermodynamic assumption made by the emergent gravity program is inconsistent with general relativity. Having performed this generalization beyond the black hole horizon places us in an ideal position to extend black hole thermodynamics to dynamical spacetimes. To do this, we first generalized the covariant energy definition to fully dynamical spacetimes.

Ref: 1. Surfaces away from horizons are not thermodynamic
Zhi-Wei Wang*, and Samuel L. Braunstein.
Nature Communications **9**, 2977 (2018).
2. Noether charge astronomy
Zhi-Wei Wang*, and Samuel L. Braunstein.
arXiv:2105.14985