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Black brane entropy and hydrodynamics

For stationary black holes it is universally known that entropy is proportional to horizon area. It is not so clear what the relationship is for dynamical black holes. In such spacetimes the event horizon is teleologically defined while the apparent horizon is non-unique. Thus even if one believes that entropy continues to be well-defined and proportional to horizon area, there are many possible areas to choose from. In this talk I will review some recent work done in collaboration with MichałHeller and MichałSpaliński that examines this problem in the context of dynamical black branes in AdS spacetimes. We work in the quasi-equilibrium regime where the horizons are slowly evolving on the gravity side while the field theory side can be described by hydrodynamics. Then a hydrodynamic entropy current can be defined and compared with the various horizon areas. We examine and attempt to identify the uncertainties in each.