



清华大学高等研究院

Institute for Advanced Study, Tsinghua University

学术报告

- Title:** What is inside a Black Hole?
And some potential applications
- Speaker:** Prof. Andre Leclair (*Cornell University*)
- Time:** 3:00pm, Tuesday, July 9, 2019
- Venue:** Conference Hall 322, Science Building, Tsinghua University

Abstract

We present solutions of the Einstein equations that extend the static Schwarzschild solution in empty space into regions of non-zero energy density ρ and radial pressure $p = w \rho$, where w is a constant equation of state parameter. For simplicity we focus mainly on solutions with constant ρ . For $w = 0$ we find solutions both with and without a singularity at the origin. Possible applications to galaxies are considered, where we find enhanced velocity rotation curves towards the edge of a galaxy. We propose that our explicit non-singular solution with $w = -1$ describes the interior of a black hole, which is a form of vacuum energy. We verify that its entropy is consistent with the Bekenstein-Hawking entropy, if one assumes the Hawking temperature. We further suggest that this idea can perhaps be applied to the dark energy of the observable universe, if one views the latter as arising from black holes as pockets of vacuum energy. We estimate the average density of such a dark energy to be approximately $1E-30 \text{ g/cm}^3$. We also speculate on applications to early time inflation.