PHYSICS AND ASTRONOMY
SEMINAR

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"How Hot Is a Relativistic Jet"

Abstract

The thermodynamic properties of a jet associated to an AGN are important to determine its feedback on the Interstellar/Intergalactic medium of its host environment. Observational evidence suggests that many jets are highly relativistic, even at distances of few tens of kiloparsecs from the central object. Even today however there is no consensus about the meaning of temperature in special relativity, and in particular about its transformation law among moving frames.
I will show that temperature can have a definite physical meaning only for thermally conducting fluids. Starting from two different theoretical treatments by Biro& Van (2010) and Garcia-Perciante et al. (2009, 2011), which expand on the relativistic thermodynamic theory of Israel& Stewart, and taking into account the seminal work by Touschek (1958), I show that the temperature of the jet is not uniquely defined. The hot photon-plasma gas composing the hot coronae of massive circumnuclear stars experiences a jet with a different temperature than that of a cold cloud. These systems represent different types of "thermometers", and I finally explore some consequences of this for the thermodynamic structure of the jet when it exits the ISM and enters into the Intergalactic medium. Flow lines are modifed by the interaction with the inhomogeneous ISM, and a complex temperature structure is passively advected over large distances into the IGM, if the jet keeps a relativistic \beta over significative distances.

Thursday, November 17, 2011
3:00 p.m.
Elliott Building
Room 160