

SEMINAR

DEPARTMENT OF PHYSICS

From Super massive Black Holes to Superluminal Jets: The Story of Active Galaxies

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It is now well-established that supermassive black holes – with masses of $\sim 10^6$ - 10^9 times that of the Sun – reside in the centers of most galaxies. In “active” galaxies, these black holes are on a feeding frenzy as they consume nearby stars, gas, and dust. So while the black holes themselves emit no light, the material in their vicinity can be observed across the electromagnetic spectrum, and it is therefore studied intensively by observational astronomers. The components of the basic “unified model” for active galaxies will be reviewed: the black hole, a hot inner accretion disk, a cool outer dusty torus, and twin relativistic outflows known as “jets.” The basic physics of jet models, and their role in “unified models” of active galaxies, will be discussed. At Trinity University, we use arrays of radio telescopes operated by the National Radio Astronomy Observatory to image these jets. These arrays let us zoom in to study jets near their formation point less than a light-year from the black hole, and to zoom out to study how they transport energy a million light-years away into intergalactic space. We have obtained many interesting results on jet structure, motion, and magnetic fields in our studies of one particular type of active galaxy, the “lobe-dominated quasars.” These include the surprising discoveries of an unstable jet axis and highly-accelerated “superluminal” (apparent faster-than-light) motion in the inner jets, only ~ 1 -100 light-years from the black hole.

