

The Black Hole Accretion Disk in NGC 4258: One of Nature's Most Beautiful Dynamical Systems

James M. Moran, from *Frontiers of Astrophysics: A Celebration of NRAO's 50th Anniversary*, ASP Conference Series, **395**, 87 (2008). Edited by Alan H. Bridle, James J. Condon, and Gareth C. Hunt.

Abstract.

In this talk I will summarize some of the work that the CfA group has done to study the structure of the water masers in the accretion disk of NGC 4258. A series of 18 epochs of VLBA data taken from 1997.3 to 2000.8 were used for this study. The vertical distribution of maser features in the systemic group was found to have a Gaussian distribution, as expected for hydrostatic equilibrium, with a σ -width of 5.1 μ as. If the disk is in hydrostatic equilibrium, its temperature is about 600K. The systemic features exhibit a small, but persistent, gradient in acceleration versus impact parameter. This characteristic may indicate the presence of a spiral density wave rotating at sub-Keplerian speed. A more precise understanding of the dynamical properties of the disk is expected to lead to a more refined estimate of the distance to the galaxy.

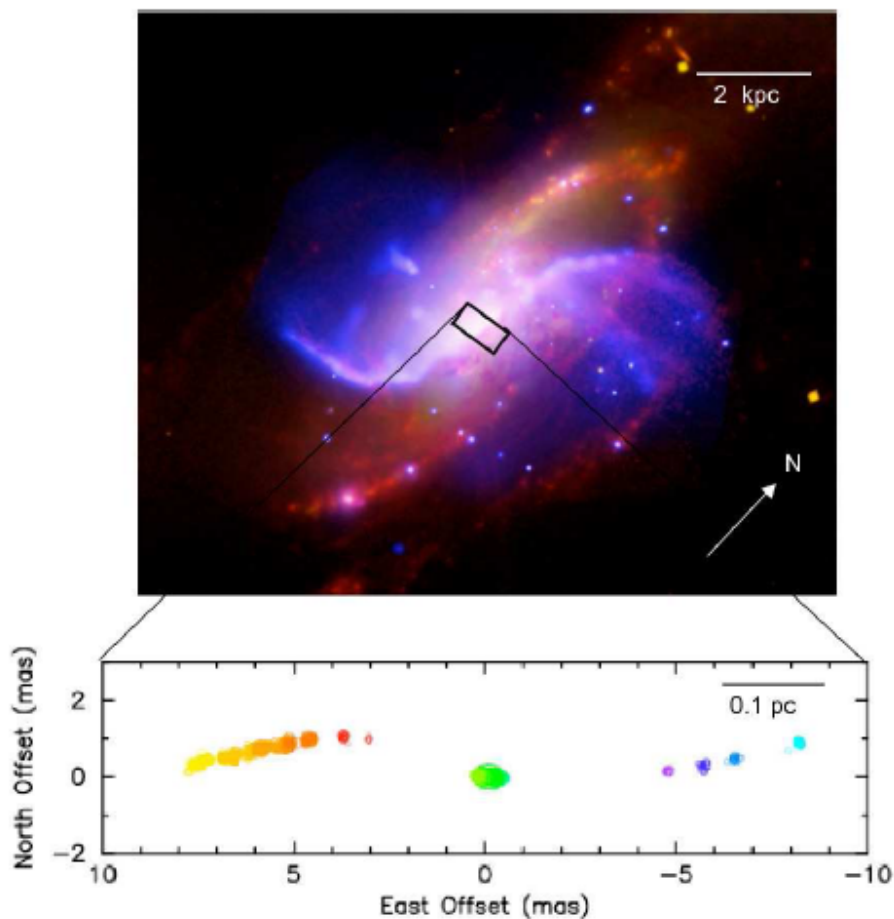


Figure 1. Top: A multiwavelength image (X-ray, H α , 1.4 GHz radio) from Yang et al. (2007) of the inner part of the galaxy NGC 4258, also known as M106. Unfortunately, this black-and-white rendition of the color image does not serve to distinguish the various wavelength regimes very well. The so-called anomalous arms, seen by their synchrotron emission, have position angles of about -45 and 135 degrees and exhibit sharp bends about 2 kpc from the nucleus. A large angle between the position angle of the accretion disk and the galaxy was surmised by Oort (1982). Bottom: Image of the maser emission from the central accretion disk of the galaxy from VLBA observations. Note that the overplotting of many maser emission spots makes the disk look much fatter than it actually is. From Argon et al. (2007)