

The Obscuring Tori of AGN: Merging Disk Wind With Radiative Transfer

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Abstract

The last decade has established beyond reasonable doubt that a significant fraction of AGN is surrounded by a toroidal structure, which is likely to consist of a large number of individually very optically thick dusty clouds. Much of the observed diversity of AGN is simply explained as the result of viewing this axisymmetric geometry from different angles. A still unresolved fundamental question is how the clouds assemble into a toroidal structure and what is providing for its vertical support. The originally proposed hydrostatic support model through cloud-cloud collisions has run into insurmountable fundamental difficulties. Our recent calculations of the IR emission from a clumpy torus indicate that it could have a size of only ~ 10 pc. This compact size lends support to the dynamical approach in which the obscuring torus is simply the optically thick region of a dusty/molecular wind coming off the AGN disk. We propose to construct AGN torus models consistent with both theoretical requirements and observations. The program is comprised of two coupled components, combining dynamic structure calculations for clumpy winds with detailed IR radiative transfer. We shall conduct a thorough investigation of disk hybrid (i.e., radiatively/hydro-magnetically-driven) wind models, to determine the kinematic and geometric structure of the obscuring torus they produce. The results of the dynamics calculations will be examined in radiative transfer calculations that will determine the IR emission produced by the wind/torus, placing observational constraints on the underlying dynamics. The outcome will be the first self-consistent model construction of the AGN obscuring torus. The proposed project addresses one of the most pressing needs of current AGN research and will develop critical tests for observations by existing and next generation of space observatories.

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