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Progress Report

TOWARDS A NEW PARADIGM OF DUST STRUCTURE IN AGN: CIRCINUS GALAXY AND BEYOND

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Recent observations which resolved the mid-infrared (MIR) emission of nearby active galactic nuclei (AGN), revealed that their dust emission appears prominently extended in the polar direction, at odds with the expectations from the canonical dusty torus. This polar dust, tentatively associated with dusty winds driven by radiation pressure, is found to have a major contribution to the MIR flux from scales of a few to hundreds of parsecs. When facing a potential change of paradigm, case studies of objects with the best intrinsic resolution are essential. One such source with a clear detection of polar dust is a nearby, well-known AGN in the Circinus galaxy. Motivated by observations across a wide wavelength range and on different spatial scales, we proposed a phenomenological model consisting of a thin dusty disk and a large-scale polar outflow in the form of a hyperboloid shell. With detailed radiative transfer modeling, we demonstrated that such a model is able to explain the peculiar MIR morphology on large scales seen by VLT/VISIR and the interferometric data from VLTI/MIDI which probe the small scales. In contrast, while providing a good fit to the integrated MIR spectrum, the dusty torus model fails to reproduce the spatially resolved interferometric data. Our results call for caution when attributing dust emission of unresolved sources entirely to the torus and warrant further investigation of the MIR emission in the polar regions of AGN. We put forth the disc + wind model of Circinus as a prototype for the dust structure in the polar dust AGN population.