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Probing AGN Inner Structures Near and Far: Insights from Infrared Interferometry

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The inner structures of active galactic nuclei (AGNs) are essential for probing the fundamental parameters of the central supermassive black hole (BH), understanding accretion physics, and investigating the physical connection between the BH and its host galaxy. The reverberation mapping (RM) technique has been widely used to study the broad-line region (BLR), the dust torus, the accretion disk, and the corona in AGNs through coordinated campaigns. These observations have confirmed our basic understanding of AGN inner regions. Recent IR interferometry has enabled spatially resolved observations of the BLR and surrounding hot dust emission. The GRAVITY instrument on the Very Large Telescope Interferometer, combining four 8-meter Unit Telescopes, provides two-dimensional spatial resolution, which is highly effective for inferring BLR structure and dynamics, as well as efficiently measuring BH masses. The combination of RM and interferometry offers a powerful diagnostic tool for detailed investigations of the BLR structure and for determining the geometric distance to the BLR. Mid- and near-IR observations of AGN continua offer new insights into the structure and composition of hot dust, which are closely linked to the BLR. In this talk, I will provide an overview of AGN nuclear structures, focusing on recent results from IR interferometry and its synergy with RM observations. I will conclude with new high-redshift quasar observations made possible by the ongoing GRAVITY+ instrument upgrade, and discuss the potential for addressing key questions about BH accretion and coevolution in the future.

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