Planet formation with long-baseline interferometry: from GRAVITY to the future

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Abstract

The formation of giant planets has been a key focus of astrophysical research for decades. Despite significant advancements in both theoretical models and observations of young forming giant planets, the mechanisms by which these planets accrete material from their protoplanetary disks remain poorly understood. Long-baseline interferometry offers a powerful tool to resolve the circumplanetary environment, enabling the study of accretion processes through the detection of circumplanetary disks. We present our recent investigation of circumplanetary emission around the PDS 70 planets using VLTI/GRAVITY. While our observations provided only upper limits on the size of the circumplanetary structures, they underscore the challenges and promise of interferometric studies in this field. Looking ahead, we explore the potential of a future kilometric-baseline interferometric facility to revolutionize our understanding of giant planet formation. Such a facility could resolve circumplanetary disks, image intricate substructures within protoplanetary disks, and trace accretion flows onto forming planets, providing direct and transformative evidence of the accretion process. These advancements would mark a significant leap forward in linking theoretical predictions with observational data, offering new pathways to unravel the mysteries of planet formation.

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