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Gravitational Instability in Post-AGB Disks: Limits on Second-Generation Planet Formation

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Disks around evolved binaries such as post-AGB binaries share many similarities with proto-planetary disks (PPDs) around young stellar objects, which has led some to believe that planet formation may occur in these systems. Here we investigate the possibility of planet formation via gravitational instabilities in post-AGB disks. We first apply the Toomre criterion of gravitational instability to several PPDs suspected of being gravitationally unstable, and then use the same criterion to investigate possible disk instabilities in post-AGB disks. We find that gravitational instabilities are not a probable scenario for the formation of planets in post-AGB disks due these disks having generally too low a mass. Even accounting for a likely larger disk mass in the recent past does not enable us to conclude that planet formation by instability took place in these systems. We also find that in the hypothetical case of planet formation with this method, the rapid mass growth of these newly born planets would result in rapid orbital decays. We conclude by discussing alternative planet formation mechanisms that may better explain the presence of planets in these evolved systems.

Author: POURMAND, Ali (Macquarie University)

Co-authors: Dr KAMATH, Devika (Macquarie University); Prof. DE MARCO, Orsola (Macquarie University)

Presenter: POURMAND, Ali (Macquarie University)

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