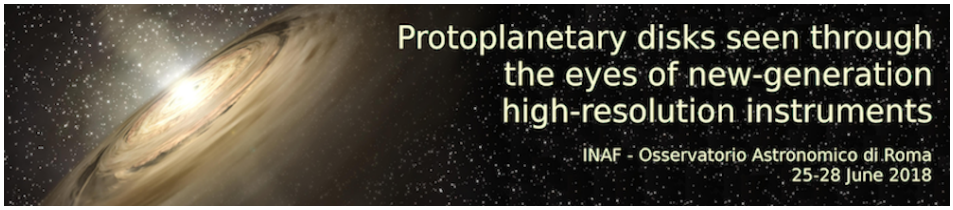

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Exploring the role of planetesimals stirred by forming giant planets in shaping the characteristics of protoplanetary disks

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The dust population in circumstellar disks is expected to steadily decrease with age due to its growth from µm-sized particles to planetesimals and planets. Using HD 163296's circumstellar disk as a test-bench, we show that the formation of giant planets globally dynamically excites the planetesimal population embedded in disks. This dynamical excitation leads to a marked increase in planetesimal impact velocities that enhances the collisional dust production, rejuvenating the grain population in the µm size range and creating the conditions for halting or reversing the expected dust decreasing trend. We use N-body simulations and statistical methods to assess the response of a planetesimal swarm populating HD 163296's disk to the formation of its three giant planets, and impact experiments and scaling laws to evaluate the outcomes of planetesimal collisions in different impact velocity regimes. We show that the appearance of HD 163296's giant planets results in tenfold-to-hundredfold increases in the collisional dust production and can still be significantly contributing to the observed dust-to-gas ratio in the disk. In addition to dust resurgence, the resulting high impact velocities could release transient, non-equilibrium gas species like H_2O due to ice sublimation. The orbital velocities of the dynamically excited planetesimals, being supersonic with respect to the gas, could also produce bow shocks and possibly cause a broadening of the gas emission lines in the affected regions.

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