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Presentation title: A new regime for disk evolution: the interplay between gravitational instability and MHD effects in 3D protoplanetary disks

We presented novel global 3D disk simulations including ideal MHD, radiative cooling and self-gravity. The simulations
are carried out using a recent hydrodynamical method, the meshless finite mass technique, that marries particle-based lagrangian hydro solvers with aspects of finite volume methods, resulting in the ability to capture angular momentum
conservation as well as ensure low diffusivity in both unmagnetzied and magnetised flows. In GI-active disks an initially weak B field can be rapidly and strongly amplified by a dynamo effect, confirming previously published local simulations.
We show how different this regime is from an MRI-driven disk as well as from a pure GI disk. Relative to the GI disk the evolution is qualitatively very different. While the flow reaches an average, nearly steady-state Toomre Q parameter that is higher owing to the build-up of magnetic pressure, large local density and magnetic field intensity fluctuations occur which locally induce the formation of vertical rolls and small over-densities along the more flocculent spiral arms. If cooling is very efficient, in the regime that would lead to fragmentation in standar GI-active disks, clumps do form but on a much smaller mass scale when the MHD dynamo is present. This has profound implications for planet formation and disk evolution, and it is potentially of critical importance since this is a regime that would take place very early in the disk lifetime.