Considerations for kinematical studies of high-z galaxies

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As telescopes' capabilities continue to improve, the resolution and sensitivity in observations of galaxies continue to improve as well, and we see emission lines of atoms and molecules we have not been able to detect before. In nearby galaxies we can separate the different kinematical structures, such as rings, outflows and rotation, and we can further understand and constrain the relations between the central black hole and the host galaxy. For high-redshift galaxies the story is more difficult to discern as these structures are undergoing intense evolution through galaxy mergers, interactions, and rapid star formation as well as secular evolution. The available resolution for distant galaxies, that is on the kpc-scale, still pose a limitation on the interpretation of the data despite having been highly improved with observatories such as ALMA. The increased resolution and sensitivity of ALMA reveal more details and emission lines in distant galaxies than ever seen before[1,2]. These emission lines may prove vital in distinguishing the different kinematical structures from each other and increasing our understanding of the evolutionary processes in galaxies through cosmic time.

So what are the effects of the limited resolution and sensitivity on our understanding of the kinematics and evolution of distant galaxies? To what extent can we derive information about the kinematical structures in high-redshift galaxies? Can we, with the current available resolution and kinematical tools, separate an outflow from a rotating component, from a merger? How can the lines of different molecular and atomic species aid us in distinguishing these structures? Which conclusions can we draw?

To answer these questions we are combining simulation and modelling tools to carry out an extensive investigation on the effects of the limitations of the data and the abilities of the kinematical tools. At this stage in the project we have simulated a rotating disk with a cored logarithmic potential using a setup similar to that which would be obtained via ALMA observations. We have applied publicly available kinematical tools on the simulated disk, Qubefit[1] and GalPaK-3D[2] (stay tuned for more), to explore these tools' ability to recreate the disk at different resolutions and noise levels. In this poster we show the preliminary results of the simulation of the rotating disk as fitted by these kinematical tools. We discuss the implications and the way forward. We happily invite you for feedback, collaboration, and discussions on the topic.

References

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