

Progress Report

The Dust Between Us and the Big Bang

PI: David C. Collins (Florida State University)

1 Previous Success

Our team has been using TACC resources since it was under the Teragrid umbrella, for nearly 20 years. This past year has been particularly successful. We have published two papers on star formation ([Collins et al. 2023a,b](#)), two papers on turbulence ([Rabatin & Collins 2023a,b](#)), and are nearly finished with the first of our CMB foreground simulations (Stalpes et al 2023, in prep.)

The two star formation papers have the potential to revolutionize our view of star formation. We examine the time history of parcels of gas on their way to becoming stars in a manner never done before. The first turbulence paper revisits the density distribution in supersonic turbulence, improving on the standard lognormal model with one that models the density as a series of shocks. These simulations were run at the low resolution of 256^3 . The second turbulence paper was a great success. We realized that resolution was key for these studies, so we increased the resolution to 1024^3 , and examined the correlation between density and velocity. The supplement to run these 9 high resolution simulations was requested in February 2023, and the paper was accepted in July 2023. The simulations were requested, run, analyzed, and published in six months. The exciting CMB foreground results, discussed earlier, were a suite of moderate resolution that will be extremely valuable in our understanding of the polarized sky.

References

Collins, D. C., Le, D., & Jimenez Vela, L. L. 2023a, MNRAS, 520, 4194

Collins, D. C., Le, D. K., & Jimenez Vela, L. L. 2023b, arXiv e-prints, arXiv:2306.10320

Rabatin, B. & Collins, D. C. 2023a, MNRAS, 525, 297

—. 2023b, MNRAS, 521, L64