COMPARISON OF TWO DISTINCT BBN CODES

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In 1993 I started working on a Big Bang Nucleosynthesis code used by UT-Austin Professors Tony Rothman and Richard Matzner (hereafter known as the Texas code) for a 1984 paper on BBN in anisotropic models, and last updated by Professors Matzner and Hannu Kurki-Suonio. (to study neutrino degeneracy in anisotropic models.) Two years later Mr. David Thomas e-mailed me a different BBN code (hereafter known as the Thomas et al code) which he used with Profs. David Schramm, Keith Olive, and Mr. Brian Fields for a series of papers starting in 1993. (This code was passed down to Thomas from Profs. Bob Wagoner to Rocky Kolb to Terry Walker.) These two different codes calculated different results for the final mass fractions X_i. In particular, the values of $X_{^4\mathrm{He}}$ disagreed by about 0.003. My poster explains the steps I took to make the codes agree to an order of magnitude of 0.0001, the order of effects that I wanted to use the codes to calculate. I found that the Thomas et al code but not the Texas code had a scheme for solving for the abundances $Y(i)$ at each timestep that had second order convergence. I also determined that a code would need at least 1000 timesteps in order to produce a value of $X_{^4\mathrm{He}}$ to my desired accuracy, and I found a way to guarantee that the codes will have around that many steps.