# Weekly Report

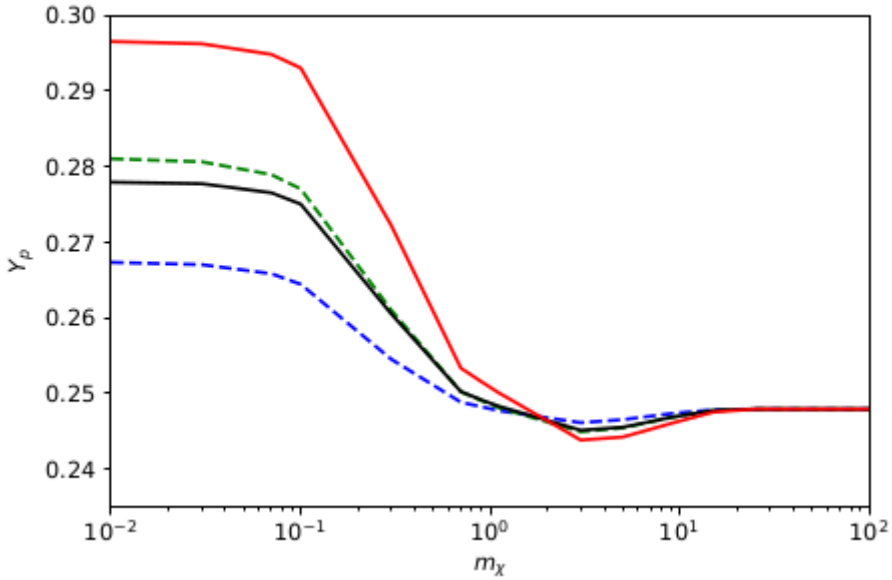
## Summary

- **Period:** Dec 23, 2020 to Jan 1, 2021
- **Task Finished:** Use AlterBBN to reproduce the BBN yields of $Y_p$ as a function of WIMP mass (reproduce Fig. 4 in arXiv:1312.5725). The real scalar, complex scalar, Majorana fermion and Dirac fermicon.
- **Questions Meet:**
  - I don't understand how to study WIMP with BBN and observables of current universe.
- **Plans for next 7 days**:
  - Discuss with Prof. Vera and try to figure out what I need to do for the next step.
  - Study and understand the connection between dark matter properties and BBN or relevant observables.
  - Do a presentation in the first week of January in 2021.

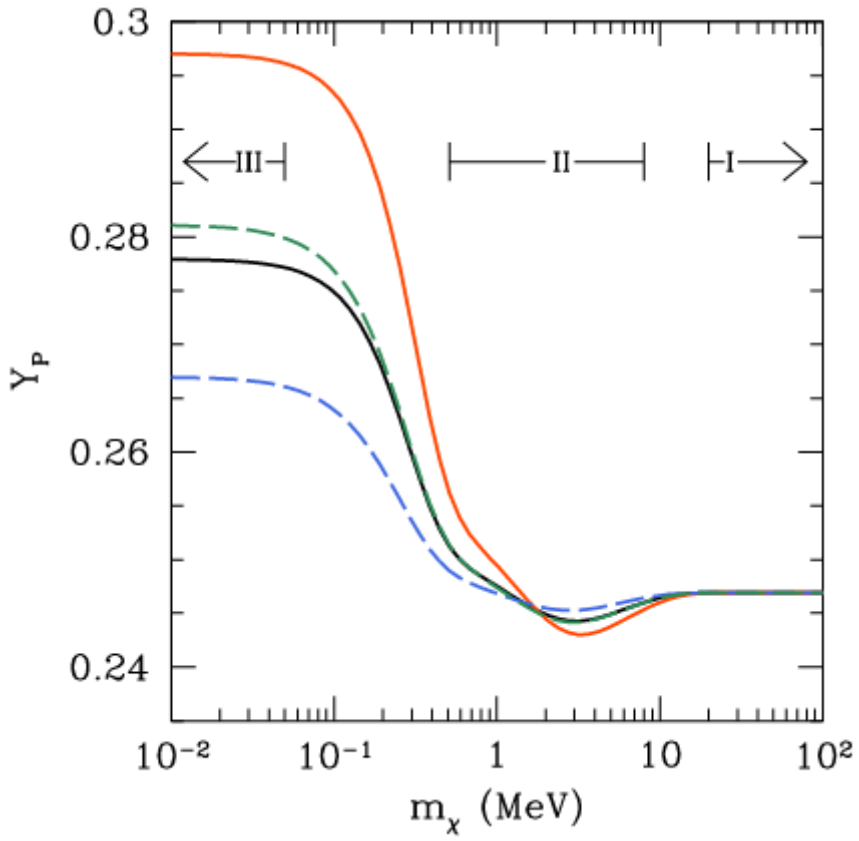
## Progress in Details

In this part, I will write a bit more about the progress for the past days. Rather than running the traditional Kawano BBN code, I use the up-to-date BBN code called the AlterBBN to calculate the $Y_p$ as a function of various kinds of WIMP and the mass of WIMP.

*AlterBBN* provides a C program called *alter_wimps.c* to compute the BBN abundances, errors and correlations in WIMP+SM particles universe. It provides the calculation for four kinds of WIMP (real scalar, complex scalar, Majorana fermion and Dirac fermion) and three kinds of coupling (neutrinos, electromagnetic and equivalent neutrinos) with certain $m_\chi$. I do the computation for all four kinds of WIMPs with electromagnetic coupling from $0.01\ \mathrm{MeV}$ to $100\ \mathrm{MeV}$. The figure is shown below.




Note that I only calculate 18 data points before plotting. More data points will make the plotting more smooth. As a comparison, I show the upper left panel of Fig.4 in arXiv:1312.5725 below.




Obviously, my plot is similar with the one in arXiv:1312.5725.