

PROBLEM SET # 4

Astro 512 – Spring 2017 Extragalactic Astronomy

PROBLEM 1: REPRODUCE THE MAIN RESULTS OF A THEORY PAPER

For this assignment, I would like you to pick an analytic theory paper in the field that you have been studying for your readings. Then, I want you to reproduce the calculation and the major plots in the paper; if your paper is long, reproducing a major subsection will suffice. You may need to absorb other papers cited in the paper you're reproducing.

A few things to keep in mind:

- Please make sure you give a full, physical motivation of the set-up and the execution of the problem. In other words, don't just start from Equation 1 and do math – make sure you explain *why* Equation 1 has the form it does, and why any subsequent approximations are valid. If something doesn't make sense, do the reading necessary to change that!
- Please pay attention to the physical meaning of intermediate equations. Make sure that the units make sense, and notice things like “this term is an energy loss term”. In other words, don't just push symbols around, but instead continually connect the to the physical world. (This is also a useful debugging exercise!) It is also useful to consider limiting cases as you do the calculation — as various quantities go to extremes, is the behavior of the function what you expect? Please include these comments/interpretations/annotations in the version you turn into me, so that is clear that you have done this intellectual work.
- You will probably find that doing the calculations can be simplified by grouping constants into new constants while you're moving terms around (i.e., “let $A = Gh/\pi$ ”). Likewise, variables can be turned into dimensionless quantities to also simplify the process (i.e., “let $x = t\sqrt{(G\rho)}$ ”). Both of these steps will make your equations more compact, which helps you notice the underlying physics while also removing opportunities for errors.

Good luck!