

Modern Physics Assignment 1 (due : Sept. 22)

1. *Breakdown of the Galilean relativity in the presence of aether (30 pts)*

Suppose that the entire space of our universe is filled with a medium called aether. Because aether is a physical entity, it will nontrivially interact with objects which move with respect to aether. In particular, objects moving relative to aether will feel dragging force. As a result, the Newton's second law will be modified.

(a) If you are in the frame which is at rest relative to aether, what will be the form of the modified Newton's second law in your frame ?

(b) If you are moving with respect to aether, show that the modified Newton's law in the moving frame will take a different form from that of (a).

(c) Using the results in (a) and (b), design a speedmeter that tells you the speed of your spaceship with respect to aether without making reference to other objects such as stars. (It will be useful in a universe (not our own) where the maximum speed of spaceships with respect to aether is regulated.)

2. *Suggested reading in the textbook*

- Section 2.1
- Appendix A