

Extra Credit #1 (10pts total)

1. The three stages in Newton's bucket experiment are:

Stage 1: water still, bucket still.

Stage 2: water still, bucket rotating.

Stage 3: water rotating, bucket rotating.

Draw spacetime diagrams for each of these stages (vertical t -axis and horizontal x -axis), indicating the worldlines of an atom of the bucket and an atom of the water.

Explain the extent to which these stages can be distinguished in the following spacetimes:

(a) Newtonian spacetime

(b) Galilean spacetime

(c) Maxwellian spacetime

(d) Leibnizian spacetime

(*Hint:* For each of these spacetimes, consider whether straight, slanted, curved, and/or twisted worldlines can be distinguished from each other, and how this allows or prevents the three stages from being distinguished from each other.)

2. Kant points out that many natural phenomena (beans growing around poles, hair growing in a spiral) have a certain handedness -- clockwise and anticlockwise are incongruent counterparts, and nature seems to pick one. So maybe the laws themselves have a handedness. Identify more contemporary examples of this handedness in nature (from chemistry, physics, etc). Could this be given a relationalist explanation? Could the absolutist do any better?