

Phys 340: HOMEWORK ASSIGNMENT No (2)

Friday, Jan. 31st

This assignment is to be handed in during or before the class on Friday Feb. 14th (Valentine's day!). Please note that late assignments will not receive a mark.

(1) Give a concise explanation of what Newton's 3 laws of dynamics say, and how they can be tested in the real world. If you also need to introduce his law of Gravitation to explain how they can be tested then by all means do so. You should pay careful attention to explaining how the various quantities like distance, time, acceleration, mass, and force are to be defined. If it helps to give examples then by all means do so.

(2) Imagine that you are unfamiliar with the forces, fields and interactions that have been discovered by physicists in the last 200 years (if you really are unfamiliar with these then so much the better!). Somebody who claims to be a magician shows you the following trick. A thin stream of water issues from a tap and falls vertically into a sink. If the water is flowing smoothly, this stream will be in the form of a thin smooth filament which slowly narrows before eventually breaking up into droplets. The magician then brings up a "magic wand" and, without touching the water in any way, shows that by putting the wand near the falling water, he can cause the direction of fall to be quite severely altered- the water stream is bent sideways. Some of you may have seen this done already. It is interesting that the magician has several wands, but they all cause the water to bend towards the wand if it is held up near the top of the water stream (and it bends more strongly if the wand is held near to the water). If the wand is held farther down, where the water stream is starting to break up into drops, one actually can see the stream bend away from the wand. However if the wand touches the water, the wand does not work at all.

The easy reaction to this (pretty common in the 16th and 17th centuries) would have been to invoke some supernatural force. How would you try and explain it? And most importantly, how would you go about testing to see whether your explanation was right? If you want to draw diagrams showing what you would do, go ahead. It is important that I am not interested in whether you know something about what is happening here- what is important is to design a way of finding out, assuming that at the outset you really have no idea of what is happening. You should give an explanation of what possibilities you can imagine, and how you could go about checking them to eliminate incorrect ones and find the ones that are consistent with what you see. To get the right attitude to start off with you might try assuming that you are aware of Newton's laws, but don't necessarily believe them- but you are also a little sceptical of the magician.

Philip Stamp

PS: This was supposed to go up on the webpage last Friday. I have not changed the date by which the assignment is supposed to be handed in (still Friday next week), but I have shortened it a bit, since it is going up today (Monday).