

Re: Determinacy in classical physics (naive question)

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"Laurent Fortel" <no.spam.please@free.fr> wrote in message
news:40f9629d\$0\$15270\$636a15ce@news.free.fr...

- > *I am no physicist, but a maths teacher trying to use his vacations time*
- > *to have a look again at the physics he learnt as an undergraduate...*
- > *Preliminary notice : I am definitely not reasoning as a physicist (a*
- > *theoretical physicist perhaps...) since physical reality is NOT the*
- > *subject of my question. Indeed my question is rather a maths question.*
- >
- > *Try to Google with "classical physics" and "deterministic". Many sources*
- > *(most of them quantum mechanics elementary expositories) will assert*
- > *with no detail that "classical physics is deterministic". One at least*
- > *precises that it means the classical theory of gravitation +*
- > *electrodynamics*
- > <http://online.redwoods.cc.ca.us/DEPTS/science/chem/storage/Schrod/>
- >
- > *What I am looking for is a precise (mathematically formalized, ideally)*
- > *proposition meaning that "classical physics is deterministic", and some*
- > *directions to look for a proof.*
- >
- > *Here is a tentative compendium of what I understand presently, any help*
- > *to go further will be welcome.*
- >
- > *1 – About gravitation :*
- >
- > *1a) A finite set of massive particules interacting via gravitation, in a*
- > *newtonian space-time.*
- >
- > *This is the only thing I fully understand. Elementary differential*
- > *equations theory asserts clearly that if I know the position and the*
- > *velocity of each particle at $t=0$, every position and velocity at $t=t_0$*
- > *are implied. No problem on this one.*
- >
- > *1b) Gravitation in a continuous universe.*
- >
- > *No idea whether this is a reasonable question (but it seemed to me an*

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- > *exercice easier than struggling with Maxwell's equations...*)
- >
- > *It seems easy to write down a non-relativistic gravitation theory*
- > *replacing the finite massive particules m_i by a distribution of volumic*
- > *mass $\mu(x,y,z,t)$, just adding down an equation for conservation of mass.*
- > *Doing it so, the data would be $\mu(x,y,z,0)$ and the velocity field*
- > *$v(x,y,z,0)$; "deterministic" would mean that $\mu(x,y,z,t)$ and $v(x,y,z,t)$*
- > *are thence uniquely determined for each t . This reminds me of no maths I*
- > *have met, but might be well-known. Any directions of reading ?*
- >
- > 2 – About electrodynamics :
- >
- > 2b) *Maxwell equations in a continuous universe (newtonian space-time*
- > *with aether, or special relativity that is the furthest I know...)*
- >
- > *Here I think I can write down a list of variables describing the*
- > *universe at time $t=0$ (μ distribution of volumic mass ; ρ distribution*
- > *of charges ; velocity field). Then I can write a list of equations*
- > *(Maxwell equations, Newton law linking derivatives of the velocity field*
- > *and the formula for force, conservation of mass (conservation of charge*
- > *being implied by Maxwell equations)). "Determinacy of classical*
- > *mechanics" would seem to mean that when you give μ , ρ and v for $t=0$,*
- > *their values for all t are implied. But the maths underneath seem at*
- > *least tricky ; how can it be that such an assumption is so universally*
- > *"well-known" while its proof is so seldom shown ? Probably I have a*
- > *completely false idea of what "determinacy of classical*
- > *electromagnetism" mean. Help !*
- >
- > 2a) (For memory only) *Classical electrodynamics for a finite set of*
- > *massive and charged particles.*
- >
- > *If I was able to write a set of equations describing that, like at 1a),*
- > *I would probably understand what their "determinacy" means, using very*
- > *simply differential equations theory. But I suppose this is hopeless, is*
- > *it ?*

Consider Chaos Theory.

It is mostly if not wholly based on classical theory.

The results are *highly inderministic*

Butterfly wings in the Amazon and all that.....etc

l.