Homework problems set 5, FYTN08, vt19

The exercises for this week (due Monday 20 May, 10.15) are:

1 Exercise 9.5 page 248

2 Exercise 9.10 page 249

3 Exercise 9.37 page 254

4 Exercise 12.9 page 370

5 Exercise 12.7 page 370

Exam schedule

Take home exam (inlämningsuppgifter) will be handed out Tuesday 21 May from 10.30, you can fetch it fom Andrew Lifson, room K235. I am away from Lund that week. If you want to get it by email, sign up on the list and write down your email (otherwise it'll be mailed to the one in Live@Lund).

Due Tuesday 28 May at 12.00 (i.e. noon not midnight), hand in at my office K240. The corrected exams should be ready Friday 31 May at 10.15. I will present the solutions then in Andromeda. We have to keep the original exams for two years but you will have the opportunity to look at them that Friday. Oral exams will be Friday 31/5, Monday 3/6, Tuesday 4/6, Wednesday 5/6 and Friday 7/6. For some reason the last week of May/first week of June is very popular to schedule various committee meetings and things like master/bachelor thesis presentations but I will make sure there are enough possibilities for the oral exam (though they might be at some odd times)

A sign-up schedule for the oral exam will be available at the May 17 lecture and at the handing in of the written exam.

Something to think about

For both of these remember how to define the mass/energy of an object.

Gravitational energy in the newtonian limit

Consider two isolated identical particles. When locating them close to each other (so that Newtonian limit still holds), one is able to extract and carry away some gravitational energy. As the energy of closed systems is conserved, this means, that the system of two particles has less energy now that they are close. Hence, the system has less mass. Does it mean, that when two gravitating bodies are placed close to each other, then they become less massive and hence less gravitating? A related question is: Can gravitational energy actually gravitate?

What happens with the mass of a star during collapse

Consider a stellar core collapsing spherically into a neutron star. Because the collapse is spherical, all the multipole moments of order higher than zero are zero. Hence, no gravitational energy is lost through gravitational waves. Hence, for an outside observer the total mass of matter is the same. However, when the protostar is still collapsing, the gravitational energy of matter has decreased significantly (being negative) and the stellar matter has a significant kinetic energy. Does it mean that the material has become more massive, but the total mass is reduced due to gravitational energy? What does it mean in terms of energy-momentum tensor?