

讲座通知

题 目: Physics by Solving Problems

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日 期: 4 月 10 日-4 月 12 日, 4 月 17 日-4 月 19 日

时 间: 18:00-19:30

地 点: A506

讲座概要:

In these 6 courses we shall address a list of different problems and learn how to solve these using our physics knowledge. These courses will be addressed to a large audience of scientific students and try to cover a large part of the first years of a typical undergraduate program, which will comprise thermodynamics, electromagnetism and optics, classical mechanics, fluid mechanics etc.. I list below some of the problems that we will address. The pace of the class will be adapted to the audience.

1 Density profile in a planet made of gas

In order to measure the density profile of a planet made of gas, with spherical symmetry, a probe is sent towards the planet and put on a trapped orbit. The trajectory of the probe is observed, and we may neglect the friction of the gaz that is dilute.

- 1) What can we say about the trajectory?
- 2) We observe that the trajectory lies in a plane and that its equation in polar coordinates can be written as

$$\rho = \frac{\rho_0}{1 + a \cos k\theta}$$

with $k > 1$. Compute the density profile of the planet, and deduce from it, the pressure and temperature profile.

2 Hole in a life preserver

You are swimming with a life-preserver made of rubber that is filled with 25 l of air at about 25°C and $P = 2 \text{ atm}$. Your friend accidentally pierces a small hole in the preserver, estimate how the pressure inside will change with time and deduce from it a typical time before it is flat.

3 An electric lens?

We consider a vertical small cylindrical recipient with at the top a supple transparent cover, that is filled with acid water. By applying a tension between the membranes, a current I flows through the water, and we will assume it is uniform. Deduce from it the shape of the cover. What is the type of the lens that is made?

4 Measure of viscosity

We shall see how we can measure the viscosity of a liquid using Couette's viscosimeter.

5 UFO disappearance?

A high altitude plane flies a little below the earth ionosphere. Its radar HF (3-30 MHz) detects an Unidentified Flying Object, it attempts to get closer to the object but the UFO disappears fully from its radar. How could the pilots of the UFO have done it to disappear?

6 Rayleigh-Bénard instability

We will study using many approximations, how a fluid can get into motion when you heat it up.

7

