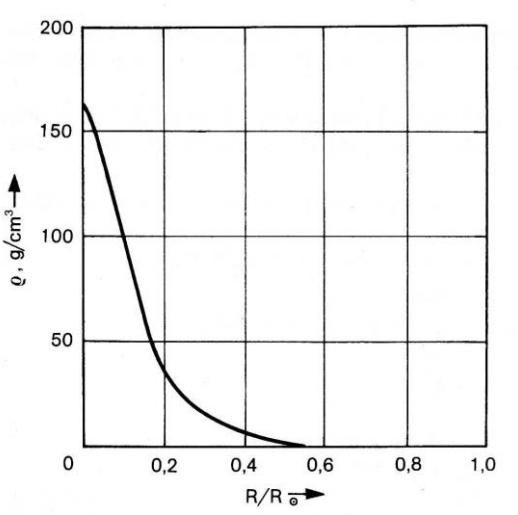
ADVANCED SOLAR PHYSICS AND SPACE WEATHER
List 2

1. The solar plasma density ρ decreases with the R. This relationship is presented on the graph nearby. Based on this graph estimate (calculate) mass of the Sun inside the sphere with a radius of 0.2 and 0.25 $R_\odot$.



How can be it done in the easiest way (taking some assumptions resulting from the shape of the graph)? How can you do it most accurately (as precisely as the graph allows).

2. Describe the neutrino/s (as a particle/s). Discuss the emission of solar neutrinos and the problem that was called the "deficit of solar neutrinos". What was this deficit and how was it solved?

3. How and why are auroras arise? Why the auroras have a different colors? Where and at what altitudes is the aurora's light visible? What is necessary for auroras (in such a form observed on Earth) can arise? (*During solution, you can show photos, schemes and charts using a projector.*)

4. How can we describe (by equations) the efficiency of the thermonuclear reactions in the solar core for the PP and CNO cycle? Both values should be calculated (for the PP and CNO cycles) for solar parameters. Obtained result should be commented. The necessary parameters for calculations should be found yourself, and the source of these values should be given.

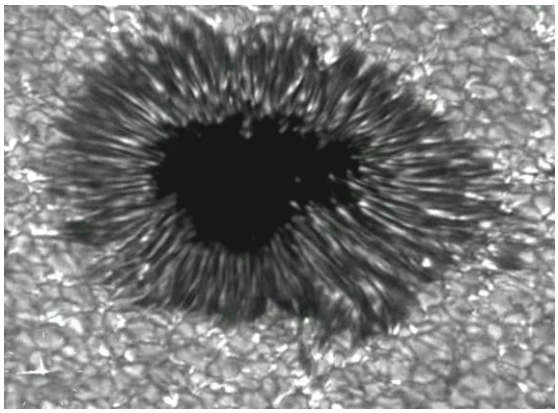
5. How can we describe (using equations) the travel time of the quantum of energy (in the form of a photon) from the solar core to the photosphere? Try to calculate the approximate value of the quantum (photon) crossing time through the radiative and convective zone. Discuss the assumptions that we must accept for calculations and discuss the received results.

6. Characterize sunspots - what are the sunspots, how sunspots are formed, where (in the Sun) sunspots occur and how long they live. Why sunspots are important when we describe the solar activity.

7. What color have the following structures: solar photosphere, penumbra of sunspot and umbra of sunspot (e.g. central part of sunspot)? Their effective temperatures (approximately) are respectively:

5800 K - photosphere
5400 K - penumbra of sunspot
4500 K - umbra of sunspot

Are these colors (calculated) in agreement with the observed colors? We assume (for calculation) that the Sun radiates like the BB.



Sunspot (black and white photo)

8. Computing task to be performed using a computer. Read the data from the file: L2_E8.dat, perform the appropriate graphs (for sunspot numbers). Discuss obtained graphs, present conclusions and provide their physical interpretation. Information concerning data can be found in the first six lines of file.

Krzysztof Radziszewski