1) A simple kinetic model of energy exchange between molecules - simulations

Poisson-distribution: The simulation can be realised as follows, for example (code in Pascal): Let ‘molArr’ be a one-dimensional array (integer) that stores for each molecule (from 0 to N–1) how many quanta it contains. The length of the array is N (number of molecules) and initially we set the number of quanta per molecule to zero for all molecules. ‘i’ is a loop variable (integer), “rd” is also an integer variable. Q is the number of quanta. The decisive part of the programme then looks like this:

```
for i:=1 to Q do
 begin
  rd:= random(N);          //generates a random number 0 to N–1
  inc(molArr[rd]);         //increments (i.e. adds the value 1)
 end;
```

Boltzmann-distribution: Like Boltzmann, we assume that the individual molecule or particle is a monochromatic resonator. Every interaction between two molecules, which we want to assume takes place randomly, should result in the transfer of exactly one quantum. The transfer cannot start from a molecule that is empty, i.e. that does not carry a quantum, but otherwise there are no further rules that determine which molecule is the donor and which is the recipient.

The source code would look like this (N: number of molecules; molArr: one-dimensional array of integer (0 to N–1). Initially, the Q quanta are somehow distributed over the cells of molArr):

```
rd1:= random(N);
rd2:= random(N);                          //rd1, rd2: integer
if (rd1<>rd2) and (molArr[rd1]>0) then
 begin
  dec(molArr[rd1]);                       // decrements (i.e. subtracts the value 1)
  inc(molArr[rd2]);
 end;
```

The simulation for the Planck-Einstein model is somewhat more complex and will therefore not be discussed further here.

2) Time and the phenomenon of "duration" – do photons require a memory?

For the ancient Egyptians, time was represented by two deities. They had a god, NEHE, who stood for periodic return and a goddess, DJET, who symbolised duration. Both were equally fundamental to them. An ideal, periodic process can serve as a measure of time, but what about duration?
Arguments keep popping up on the internet that try (unsuccessfully) to prove that the special theory of relativity is wrong. A particularly amusing one concerns the twin paradox: "If you move faster, time passes more slowly, the distance in the direction of movement shortens and the mass increases. When the twin returns from his almost light-fast journey, he is younger than the other, which remained behind at the starting point". "Why," is the subsequent question (and it is never wrong to ask a question), "is he not also compressed or heavier when he returns?"
The question is very easy to answer and the answer is also instructive. The theory of relativity says something about measures (standards), in the case of time this is an ideal, periodic process, such as an oscillation (like a pendulum) or a rotation. When the twin returns from his journey through space and the two meet, they will realise by comparison that all the measures of the two twins match again. Ideal oscillators oscillate at the same speed, the distance measures match and so do the mass measures, just as the theory predicts. But apparently, in addition to the time measure, there is another fundamental characteristic of time, a counter (Fig. 1.1), which we can call "duration" and which integrates over time. This is not the same as getting older, but getting older requires duration (memory too). Our photons also have duration, but without getting older. It is undoubtedly an important characteristic of time, but one that special relativity does not deal with. The questioner has therefore confused NEHE and DJET. Only the measures have to match when the twins meet, but not their age, their duration.

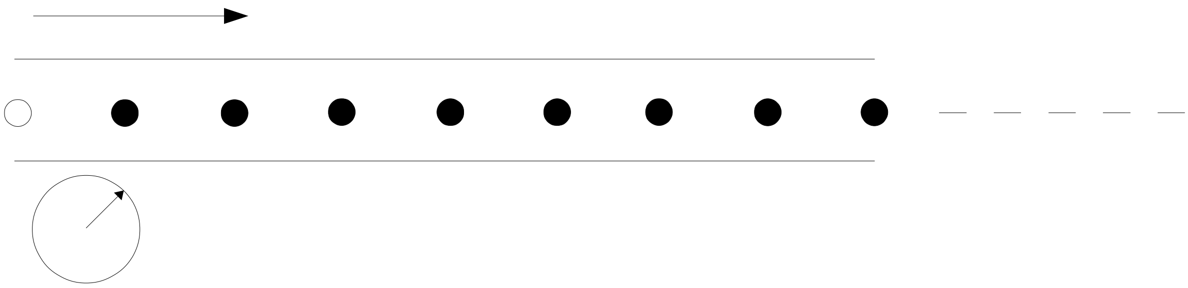

Fig. 2.1: Periodic process (rotation or oscillation) as a measure of time (bottom), represented by a clock face with a hand. Duration as an integral over time (or as a sum in the discrete example), represented by a strip that always moves in the same direction and in which a hole is punched when the hand passes the 12 o'clock position during its ideal rotation.

The fact that we only observe the integration over time, but not over space, may have something to do with the circumstance that we cannot move freely along the time axis, but only in one direction, which is why the strip in Fig. 1.1 only ever moves in one direction. This is not the case in space; the strip would move both to the left and to the right (if we only consider one spatial dimension).
Incidentally, in his works of 1905 and 1907, A. Einstein did not clearly separate the two phenomena of "measure of time" and "duration" when describing his clock, which obviously caused problems of understanding later on (his clock, like a real clock, is a hybrid that also determines the duration up to a certain period of time).