2×10^{13} cm^{-2}. Assuming H^* to be 10^8 cm, the scale height of the chromosphere, we get $n_8 \approx 2 \times 10^5$ cm^{-3}, and hence $n_e n_i / n_8 \approx 5 \times 10^{20}$. However, for a wide range of temperature, i.e. for $T = 5000°$ and $15{,}000°$, we have $n_e n_i / n_8 = 8 \times 10^{18}$ and 6×10^{19}. On the average there is a discrepancy of the order of 1/20.

In order that this ratio should take plausible values, one would have to assume a very small thickness for the flare of the order of 50 km, 1/20 the scale height of the chromosphere.

The only plausible interpretation, it appears to us, is that the flare consists of a great many very thin thread-like condensations, i.e. lightnings, presumably distributed over the whole extension of the chromosphere.

12. ON THE NATURE OF FINE STRUCTURE OF ACTIVE REGIONS ON THE SUN

I. S. SHKLOVSKY

The author has recently considered theoretically the problem of moustaches, the phenomenon investigated by Severny [1, 2]. The phenomenon indicates the motion of emitting hydrogen atoms with velocities 500–1000 km/sec. If the lifetime of moustaches is of the order 100 sec, the emitting matter must reappear 10^3 times during the lifetime of this formation.

Considerations of possible sources of excitation have led the author to the following conclusions. If in some active region (of the size of 100 km) separate small portions or 'knots' of rapidly moving matter are formed, these 'knots' interact with photospheric plasma. The interaction consists of inelastic collision between H-atoms and some shock-front phenomena. These phenomena resemble the mechanism of excitation of H-atoms in aurorae [3, 4]. The main source of excitation in moustaches is connected with the transfer of excitation from excited H-atoms of these rapidly moving knots to the same atoms of photospheric plasma. The 'quantum output' for this process may reach 5 photons per rapidly moving H-atom. This permits us to evaluate the total number of Hα-quanta emitted by an active region during a moustache lifetime and also the total mass of a 'knot'. This mass is about 10^{13} g, that is, $\sim 3 \times 10^{-4}$ of the total mass of the active region in the photosphere. The total energy of the knots is 10^{28} ergs and it is of the same order as the magnetic energy of the active regions, which is the most probable source of the energy of moustaches. The instability of plasma in magnetic fields may be considered as a probable source of the phenomenon of moustaches, which is in some respects quite similar to the phenomenon of plasmons.

The wide spread of velocities (10^8 cm/sec) in small regions of the chromosphere (10^8 cm) may also produce favourable conditions for the acceleration of particles up to relativistic energies by means of some kind of statistical mechanism of the Fermi type. The possibility of that process in the photosphere is ruled out owing to very high ionization losses.

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