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**Super Hot Hydrogen Atoms in Microwave Plasmas** EDGAR FELIZARDO, ELENA TATAROVA, FRANCISCO DIAS, M LINO DA SILVA, CARLOS FERREIRA, IPFN - IST, Portugal, BORIS GORDIETS, Lebedev Physics Institute, Moscow, IPFN - IST, PORTUGAL TEAM, LEBEDEV PHYSICS INSTITUTE, MOSCOW, RUSSIA COLLABORATION — "Super hot" (with kinetic energy in the range 4 - 8 eV) and "hot" (kinetic energy $\sim$ 0.3 eV) hydrogen atoms were detected throughout the volume of a surface wave (500 MHz) generated $H_2$ plasma column, at pressure p = 0.01 mbar, from the analysis of the $H_\beta$, $H_\gamma$, $H_\delta$and $H_\varepsilon$ emission line profiles. The profiles were found to evolve from single Gaussian to bi-Gaussian towards the column end. Population inversion between the levels 5$\rightarrow$4 and 6$\rightarrow$4 was detected from the measured relative intensities of transitions within the Balmer series. The Doppler temperatures corresponding to the $H_\beta$, $H_\gamma$, $H_\delta$, $H_\varepsilon$ line broadening are much higher than the rotational temperature, as measured from the hydrogen molecular Fulcher-$\alpha$ band (350 – 500 K), and than the wall temperature (300 – 450 K). At pressure p = 0.2 mbar, "super hot" atoms were not detected while "hot" atoms are present. It has also been found that the kinetic temperature of excited H ($n$ = 4 -7) atoms, as determined from the fitting of the spectral lines with a single Gaussian profile, increases with the upper level principal quantum number. These experimental results are analyzed in the framework of a kinetic model, which accounts for the generation of three groups of atoms.

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