front broadening of selfignited discharge and heated by powerful THz radiation [[1]](#footnote-1)\*)

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The terahertz range, which lies between the microwave and optical parts of the spectrum of electromagnetic waves, has remained as the least studied range for a long time, including the point of view of the gas discharge physics. For gas discharge there is no general theory which covers the entire range of EM waves. But the difference between the microwave discharge and the laser spark appears not only in the densities of the produced plasma, but also in the different mechanism of spreading the front of the discharge. In case of a microwave discharge, discharge propagation determined by gas heating in front of it (10^4-10^5cm/s) [1], while for laser self-ignited discharges this is the detonation mode of front spread (10^7 cm/s) [2], which is almost impossible for microwave breakdown. Therefore, the study of the front spread process for the intermediate THz frequency range is a new problem which can be interesting for both theoretical and applied research[3].

This work was done on two setups, where the gyrotrons as a source of powerful THz radiation were used. One of them has 40kW output power at frequency 670GHz and the second one has 250kW at 250GHz. All of them have been previously described in our works [4]. In both cases gyrotron radiation was focused into the vacuum chamber by the quasioptical mirrors system. Discharge appeared in the beam waist whose front was propagating towards heating THz radiation. Measurements of propagation velocity were carried out in several ways: by delay between signals from photodetectors spaced apart, by snapshots from a camera with a high-speed shutter, by images from streak-camera.

In this work, we measured the propagation velocity of a discharge for various gases (HeAr, Ar, Kr, N2) over a wide range of discharge existence pressures. Experimentally shown that speed depends from the gas type. The heavier the gas, the lesser discharge propagation speed occurred in it. It was also noted that the spread velocity decreases with increasing pressure and depends on the value of the local electric field density. But propagating mechanisms of THz discharge is the subject of further research.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Lt/ru/EF-Veselov.docx) [↑](#footnote-ref-1)