Current informatics and communication technologies aim at using the last not used frequency band - the terahertz band (THz). This is the range of the electromagnetic spectrum where the field of a wave changes about 10^{12} times per second, and their wave length is equal to about 0.1 mm. The THz band borders two other bands - microwaves (at lower frequency) and optics (at higher frequency). Electronics and optoelectronics of these two bands is very well developed which is justified by thousands of applications which are our companions at every day life. One of the reasons is that efficient emitters and sensitive detectors are extremly well performant at visible and microwave radiation. The situation is quite different in the case of THz radiation - there are practically no small, cheap and efficient sources and sensitive detectors. Partially, it is casued by the fact that a THz band is experimentally difficult because all signals with that frequency can be easily hidden in the noise generated by the environement - just, the energy of photons related to this noise, which is called a thermal excitations energy - is much higher then the energy carried by THz photons.

THz technolgies would stay long totally unnoticed if it was not shown that THz radiation can be extremly useful in areas which are crucial for the society. THz radiation passes through such materials as plastic, paper, wood, which offers applications in security systems or nondestructive quality testing. Many explosives can be detected and recognized with THz spectroscopy because their absorption spectra show characteristic spectral features at these frequencies. Besides, a THz radiation can be used in a medical diagnostics, e.g., to determine cancer tissues, mainly of the skin. These facts indicate important social benefits which one can get from development of THz radiation, which relies on construction of sources, detectors, filters, phase shifters, modulators, frequency multipliers and other elements which - connected in an appropriate way - can be assambled in a device with new possibilities. A post-office scanner is such a device which, using a THz beam, verifies if the letter or a parcel contains a dangerous material or not. Yet another aspect of THz technology is a run for a quicker then today information handling.

The proposed project is a part of a general efforts directed towards fabrication of cheap sources of THz radiaiton. Our attention was drawn by long-time known Gunn effect in which electrons in a current flowing through a sample in certain conditions (typically - under a strong enough bias) start to group in bunches. The current in such conditions is not constant in time but it becomes pulsed - it rapidly grows when a bunch of electrons arrives to one end of the sample and is almost zero when the bunch is between its ends. Such a pulsed current is a cource of radiation with the frequency of the order of 10^{11} - 10^{12} Hz.

Basing on previous studies, we know how to fabricate a Gunn generator on a semiconductor „sandwich” composed of layers of GaAs and GaAlAs (it is so called GaAs/AlGaAs heterostructure containing a two-dimensional electron plasma). In this project we plan to fabricate a chain N Gunn oscillators (N will be equal to about 10) and make them oscillate in a synchronous was. We expect that the power of emitted radiation will increase (with comparison to a single generator) not N times but N^2 times, and the reason of this increase will be a coherent superposition of waves generated by all oscillators.

The other type of structures, which we plan to study, is a device in which a single Gunn generator will excite perturbations of the density of electrons propagating in an electron plasma, i.e., so called plasma waves. An appropriate construction of the area in which these waves will propagate will be responsible for an efficient generation of radiation.

We expect that realization of the project will allow to construct cheap generators of radiation with the frequency of the order of 10^{11} Hz which will be useful in basic research and applications.