Hard disk drives (HDD) were invented over 50 years ago at IBM. Since the mid-1980s they have been used in personal computers. The long term computer storage in HDD relies on magnetism because the contents of the memory cell is preserved even when the power is switched off. Hard drives have few advantages such as high-capacity and affordability, but they are far from an ideal storage media. Firstly, due to a relatively heavy power consumption. Secondly, the speed of operation is rather low, because it takes relatively long time for the read-write head to access the required information. The information is written by generating a strong local magnetic field that changes the direction of the magnetization of a small precisely defined region (bit) in HDD. One way to reduce the energy required for flipping the magnetization inside the memory cell is to independently control the magnetization by a variable other than magnetic field (or temperature), that is to develop a new magnetization reversal scheme, which would minimize the use of charge current. For example, magnetization reversal induced solely by electric field reduces switching power by a few orders of magnitude in comparison with other approaches, because only a relatively weak charge/discharge current is required to drive the capacitor which generates the required electric field for magnetization switching. It is also scalable, compliant with current industry processing standards and is fast since it offers a random access and no mechanical positioning is required. To accomplish this goal, it is then crucial to search for a stable material system with both large magnetic anisotropy energy and its high sensitivity to the applied electric fields. We anticipate that both prerequisites will be fulfilled by (Ga,Mn)N based structures, a (ferro-)magnetic form of ever so technologically important GaN semiconductor. Nitride family in becoming nowadays the second most important semiconductors after silicon, being widely employed as sources of light, and in high power/high frequency electronics.

In (Ga,Mn)N the magnitude and the sign of magnetic anisotropy can be controlled by appropriate strain engineering and by electric field. In this Project we aim to demonstrate a possibility of achieving repeatable precessional magnetization switching induced solely by external electric field. This mechanism will be driven by a new, recently discovered mechanism in (Ga,Mn)N, which couples the magnitude of the magnetic anisotropy with the deformation of the Mn ion environment through the inverse piezoelectric effect. The precession itself will be initiated by a temporal change of the direction of magnetic easy axis realized in carefully engineered structures by the application of sub-nanosecond voltage pulses. Despite the fact that all the measurements will be performed at very low cryogenic temperatures (the currently available material undergoes transition to the ferromagnetic phase only around liquid helium temperatures, -269 ^{o}C), it is expected that the proven in this Project concept will draw material science researches to this field of activity and similar material systems, operating however at much higher temperatures, will soon be found or elaborated.