Nuclear-Precessional Hydroscope

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The purpose of this project is to develop effective and inexpensive device for remote sensing of subsurface water-carrying layers. I suggest to use the water protons response to an artificial constant magnetic field orthogonal to geomagnetic field (i.e. free nuclear precession – FNP). For subsurface water-carrying layer detecting I developed an original antenna consisting of two coaxial frames whose sizes are comparable to sensing depth. An internal frame is used for both stimulation and registration of FNP signal and an external frame – for signal registration only. This construction allows to realize natural noises spatial compensation. Estimations show that the level of FNP signal while water protons magnetic moments declining by constant magnetic field at 100 m depth within a frequency band determined by relaxation time is comparable to the level of natural noise in a vertical component of magnetic field at the frequency close to FNP one. There was constructed a laboratory setup and a proton magnetometer sensor by means of which I conducted series of FNP signal measurement for the samples of subsurface water. This experiment proves the possibility of FNP signal temporal accumulation and increasing the signal/noise ratio through the application of specially developed processing procedure to the received signal. For each water sample the level of the water protons response at spectral peak frequency of 2260 Hz in dependence to time was recorded and relaxation time was calculated. Suggested method allows to create a device that due to increasing the signal/noise ratio by more than three orders may be used for subsurface water resources estimating and state forecasting as well as for decreasing the risk of natural and technological disasters and terroristic threats.