O9: Optically pumped magetometer: in radiofrequency (RF) spectroscopy and in electrophysiologic measurements

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C. F. Gauss with his magnetometer (1832) is considered as the first-one in the group of researchers, followed by Hall, Foerster and others with their high sensitive magnetometers, who contributed to the quantitative magnetometry. The development of magnetometers is a continuous process and we have seen here applications of some spectroscopies as well as macroscopic quantum devices – SQUID (superconducting quantum interference device) magnetometers. All these magnetometers enable us to measure with high precision magnetic fields from the Earth's magnetic field to magnetization of different materials and also magnetic fields caused by the electrophisiologic activities of some organs. This means, we can measure magnetic fields from 10^{-5} T to 10^{-15} T and less. Today, optically pumped magnetometers, using vapours of alkaline metals (K, Rb or Cs), which we shall consider, can achieve the sensitivity of about 10^{-16} T (few tens of fT) and their theoretical sensitivity is even better than this of SQUID magnetometer. Magnetometers with vapours of alkaline metals are known since 1957 (Dehmelt, Bell and Bloom, Kastler), however, it was necessary to have a stable tunable diode laser in order to achieve recently the mentioned sensitivity. Principles of the optically pumped magnetometer with potassium (K) atoms vapour will be presented. An application of such magnetometer in the low frequency RF spectroscopy (^{14}N NQR), as well as in quasi DC measurements of stimulated activity of human audio cortex [1, 2] will be shown.

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