The main goal of this thesis was to develop an experimental technique for investigation of ferromagnetic and antiferromagnetic materials using magneto-optical effects that are quadratic in magnetization. Using a prototype of 2-dimensional electromagnet, which enables to rotate magnetic field of constant magnitude in the sample plane, we were able to study spectral dependences and anisotropies of corresponding magneto-optical coefficients. In ferromagnetic semiconductor GaMnAs we revealed that the anisotropy of Voigt effect magneto-optical coefficient is strongly wavelength dependent – this coefficient can be both isotropic and anisotropic. Very strong anisotropy of this coefficient was observed for metallic FeRh in a ferromagnetic state. Finally, a new method that can be used to measure Voigt effect in antiferromagnetic state of FeRh was demonstrated.