

Ultrafast spin dynamics probed by optical pump-probe STM

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Time resolved spectroscopy using optical pump probe (OPP) technique has been widely used to probe ultrafast dynamics of various physical phenomena with femto second time resolution. By combining OPP technique with STM, we have established new microscopy technique which enables us to probe ultrafast dynamics with atomic spatial resolution. Recently time resolved STM has been further improved to be able to probe electron spin dynamics on semiconductor. Spins are optically oriented in GaAs using circularly polarized pulses and their dynamics are probed by STM. Experiments were carried out at 2.5K ~ 300K for various doping GaAs(110) surface and GaAs/AlGaAs quantum well. Electron spin lifetime in GaAs has been successfully measured with sub pico second time resolution and nanoscale spatial resolution. Furthermore, precession motion of electron spin in n-GaAs was directly observed under in-plane high magnetic field at 2.5K. Method details and results will be presented in this talk.