Exciton quantum beats in CdMnTe quantum wells

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We report on the observation of the teraherz quantum beats in the four level system consisting of the heavy hole exciton states coupled to the magnetic ions via exchange interaction. Such states are prepared in CdMnTe quantum well where the magnetic field applied at 45° with respect to the sample surface normal both lifts the degeneracy of spin states and couples all the four states to the light. We show that the time-resolved Kerr rotation (KR) signal provides the information on the dynamics of the spin transitions in this complex system via circular birefringence (i) which makes the KR signal oscillate when the spin polarization created by the circularly polarized pump pulse precesses in the magnetic field; the linear birefringence (ii) gives rise to the KR signal even in the absence of the net spin polarization, e.g. when the exciton states are excited by the linearly polarized pump pulse, provided that the pump and probe pulse polarizations are not collinear. The combination of these two effects enables the control of the excitonic transitions, which contribute in the KR signal, by adjusting the pump and probe polarizations as well as the orientation of the field.