Principal Researcher	Takayoshi Kobayashi	Number of Researchers	2
Research Institution · Department · Title	Professor, Department of Physics, The University of Tokyo	Location of Institution	Bunkyo-ku, Tokyo

Title of Project	Development of Extremely-short-pulse Generation and Establishment of Ultra-fast Real-time Spectroscopy
Abstract of Research Project	Therearethreegoalsfortheproject: **(1)Generation of extremely-shortpulses** We have developed the shortest visible laser pulse of 3.9 fs (2001) ever generated in the world. In the project new originalinnovationswillbemadetoachieveanextremely-shortpulse.Thatis,sub-3-fslaser pulse, which corresponds to sub-2 cycles of electric-field of light, robust and stable for long experiment time,verywidebandappropriatetobothlinearandnonlinearspectroscopies. It will be the shortest visible laser pulseintheworld. **(2) Development ofnew method tocharacterize ultra-fast optical pulses** For sub-5-fs optical pulses,it has beenknown that the pulse-width, or pulse-phase characterization with high precision is verydifficult. To develop a new method for such pulsesisthesecondtarget.Fasterandmore convenient method than well-knownnowexistingmethodsfor pulsecharacterizationofextremely-short pulses canbeappliedtofast feedbackcontrol of lasers. A new control methodwillbedeveloped for optimizingandstabilizingthelaser pulsewiththe new characterization method. **(3) Establishment ofanewreal-timetransition-statespectroscopy** Theworldshortest laser pulsesaretobeusedtostudyinteractionsbetweentheopticalpulsesandmaterials, especiallyforstudiesindynamicsofultrafastmolecularvibrationsingroundandexcitedstates.Toillustrate the dynamics ofmolecular vibrations for transition states; vibration modes,energytransfer,and behavior of dynamic mode coupling in detail, which has been understood to be difficult, will solve mechanism of chemicalreactions. Thenewpowerfultoolnamed **transition-state spectroscopy** willbeestablished.
References	1. Real-time spectroscopy of transition states inbacteriorhodopsin during retinalisomerization, Nature, Vol. 414, pp. 531--534, 2001. 2.Controlling the carrier-envelope phase of ultrashort light pulses with optical parametric amplifiers Phys.Rev. Lett., vol.88,pp.133901--133904, 2002.
Term of Project	Fiscal years 2002-2005. (4years)

Budget Allocation (in thousand of yen)	FY2002	FY2003	FY2004	FY2005	FY2006	TOTAL
	50,000	15,100	12,900	13,600	0	91,600