Principal Researcher	Hideo KOZONO	Number of Researchers	10
Research Institution Department Title	Professor, Graduate School of Science, Tohoku University	Location of Institution	SENDAI
Title of Project	United theory of existence of global solution and its asymptotic behavior to the nonlinear partial differential equations		
Abstract of Research Project	In this research, based on the significant development of the theory of modern analysis in the last century, we investigate well-posedness for general nonlinear partial differential equations such as existence, uniqueness and stability of solutions. To begin with, we will deal with the problem on local well-posedness of PDE. Our final purpose is to establish a unified theory of global well-posedness which will provide us a new view on the research into nonlinear PDEs in this new century. In addition to the classical approach via functional analysis, we will make fully use of the recent development in the harmonic analysis, which seems to characterize our project. More precisely, we will construct three research groups which consist of hydrodynamics equations, nonlinear wave and dispersive equations and reaction diffusion equations. In the research group on hydrodynamics, we will treat the problem on regularity of weak solutions to the Navier-Stokes equations. In terms of the Fourier restriction norm method and the I-method, we will try to take the space of initial data as large as possible which solves the KdV and the Benjamin-Ono equations globally in time. This is the main theme of the research group of nonlinear wave and dispersive equations. The shadow system will be investigated to determine the asymptotic behavior of solutions to the Gierer-Meinhardt equations, which will be carried out in the research group of reaction diffusion equations. In particular, it should be noted that the problem on existence of global smooth solutions to the 3D Navier-Stokes equations for arbitrary initial data was proposed by the Clay institute as one of the seven open questions in mathematics in the millennium each winner of which will get one million dollars. Furthermore, the Yang-Mills equations on the Lorentz manifold is reduced to the Cauchy problem on the nonlinear wave equations such as the wave map, which is closely related to another question on the color Gauge theory. We see that the theme of our project not only lies in the subject of nonlinear PDE but also has a great influence upon the whole mathematical science such as the Riemann conjecture.		
References	1. Kozono, H., Mathematical theory of turbulence, Parity 18 (2003), 28-35 (Japanese). 2. Kozono, H., Navier-Stokes equations Clay Institute Millennium Problem, Sugaku 54(2002), 178-202 (Japanese). 3. Kozono, H., Shibata, Y., Recent Topics on Mathematical Theory of Viscous Incompressible Fluid, Lecture Notes in Numerical and Applied Analysis Vol.16, Kinokuniya 1998.		
Term of Project	Fiscal years 2003-2007 . (5years)		

Budget Allocation (in thousand of yen)	FY2003	FY2004	FY2005	FY2006	FY2007	TOTAL
	14,400	11,500	10,800	10,800	13,500	61,000

Homepage Address	None