

Noncommutativity and Singularities  
Proceedings of French–Japanese symposia held at IHÉS in 2006

**ADVANCED STUDIES  
IN PURE MATHEMATICS 55**

Chief Editor of the Series: Sadayoshi Kojima (Tokyo Institute of Technology)

**Noncommutativity and Singularities**

Proceedings of French–Japanese symposia held at IHÉS in 2006

Edited by

**Jean-Pierre Bourguignon**

(Institut des Hautes Études Scientifiques)

**Motoko Kotani**

(Tohoku University)

**Yoshiaki Maeda**

(Keio University)

**Nobuyuki Tose**

(Keio University)



Mathematical Society of Japan

*This book was typeset by  $\text{AMS-}\text{T}_{\text{E}}\text{X}$  and  $\text{AMS-}\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ , the  $\text{T}_{\text{E}}\text{X}$  macro systems of the American Mathematical Society, together with the style files `aspm.sty` and `aspmfm.sty` for  $\text{AMS-}\text{T}_{\text{E}}\text{X}$  written by Dr. Chiaki Tsukamoto and `aspmproc.sty` for  $\text{AMS-}\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$  written by Dr. Akihiro Munemasa and `aspm.cls` for  $\text{AMS-}\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$  provided by Tokyo Shoseki Printing Co., Ltd.*

*$\text{T}_{\text{E}}\text{X}$  is a trademark of the American Mathematical Society.*

©2009 by the Mathematical Society of Japan.

*All rights reserved. The Mathematical Society of Japan retains the copyright of the articles in the present volume except those indicated in the footnotes. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.*

*Edited by the Mathematical Society of Japan.*

*Published by the Mathematical Society of Japan.*

*Distributed by the Mathematical Society of Japan, the American Mathematical Society and the World Scientific Publishing Co., Ltd.*

*Distributed exclusively in North America by the American Mathematical Society.*

*Advanced Studies in Pure Mathematics 55*

*ISBN 978-4-931469-54-9*

PRINTED IN JAPAN  
by Tokyo Shoseki Printing Co., Ltd.

*2000 Mathematics Subject Classification.*

*Primary 58-06.*

*Secondary 58L30, 58B34.*

## Advanced Studies in Pure Mathematics

Chief Editor

Sadayoshi Kojima (Tokyo Inst. of Tech.)

### Editorial Board of the Series

MARTIN GUEST (Tokyo Metro. Univ.)	SHIHOKO ISHII (Tokyo Inst. of Tech.)	TOSHITAKE KOHNO (Univ. of Tokyo)
SADAYOSHI KOJIMA (Tokyo Inst. of Tech.)	MOTOKO KOTANI (Tohoku Univ.)	KIMIO MIYAJIMA (Kagoshima Univ.)
MASATOSHI NOUMI (Kobe Univ.)	TAKAYUKI ODA (Univ. of Tokyo)	KEIJI OGUIO (Osaka Univ.)
MASAYOSHI TAKEDA (Tohoku Univ.)	YOSHIHIRO TONEGAWA (Hokkaido Univ.)	AKIHIKO YUKIE (Tohoku Univ.)