

The Founders of Index Theory

The Founders of Index Theory

reminiscences of and about

*Sir Michael Atiyah, Raoul Bott,
Friedrich Hirzebruch, and I.M. Singer*

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second edition



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Atiyah, Bott, Hirzebruch, and Singer are not only first-rate mathematicians who transformed mathematics in a profound way, but also belong to a rare class of researchers whose interest and influence go far beyond conventional boundaries of fields.

As a physicist I have witnessed the impact of their works on broad ranges of topics in theoretical physics: From application of index theorems to counting of generations of elementary particles and determination of consistency conditions for quantum field theories, to periodicity theorems and their role in string theory and D-branes, to the power of localization theorems in computations of physical correlations functions, we witness again and again a vast array of topics upon which their research has had an impact.

Moreover their warm personalities, combined with a clear vision of the unity of mathematics and physics, have been a true inspiration for many physicists of my generation.

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April 2009

Preface

In 1999, Harvard University hosted a conference dedicated to four great mathematicians—Sir Michael Atiyah, Raoul Bott, Friedrich Hirzebruch, and I.M. Singer—who are joined by the fact that each has made great contributions to the index theorem of elliptic operators. This subject has exerted a profound influence in mathematics over the last half-century. In the 1970s, the significance of their contributions also began to emerge in theoretical physics.

The first edition of this volume, published in 2003 to honor the creators of this subject, was warmly received by the mathematical community. Ten years after the Harvard conference, we believe there is need of a second edition to present both new and revised materials, and to provide corrections to the first edition.

Although, sadly, Professor Bott passed away four years ago, this year bears witness to MIT holding a conference to celebrate Singer's 85th birthday, and the University of Edinburgh celebrating Atiyah's 80th. Last year several European conferences commemorated the 80th birthday of Hirzebruch. We hope this second edition will contribute to honoring these four men and their long and illustrious careers.

We are grateful to Hirzebruch, Loring Tu of Tufts University, and Candace Bott, for their valuable assistance in preparing this second edition.

Shing-Tung Yau
Harvard University
April 2009

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