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BULLETIN (New Series) OF THE
AMERICAN MATHEMATICAL SOCIETY
Volume 18, Number 1, January 1988

0273-0979/88 $1.00 + $.25 per page

Symplectic techniques in physics, by Victor Guillemin and Shlomo Sternberg, Cambridge University Press, Cambridge, London, New York, New Rochelle, Melbourne, Sydney, 1986, xi + 468 pp., $49.50. ISBN 0-521-24866-3

This book, aimed at a mixed public of physicists and mathematicians, starts with a 150-page chapter, called the Introduction, on optics. The purpose of this introduction is to illustrate the importance of symplectic geometry for physics.

The primitive way in which the discussion starts with Gaussian optics may serve as an eye-opener for some. However, it may also make a somewhat artificial impression on those who already have seen the relation between Snell's law, Fermat's principle, and Hamilton's treatment of geometric optics in some early physics course.

The subsequent epic story of Fresnel's discovery of the wave nature of light, leading to oscillatory integrals, is always very impressive. Here I am curious whether Fresnel himself really used complex notation as suggested in the book. Also I missed the end of the story, explaining light, and in particular its polarization, as rapidly oscillating solutions of Maxwell's equations.

Instead the book takes a surprising and exciting turn to use Fresnel integrals in order to pass to the standard representation of the metaplectic group on $L^2(\mathbf{R}^n)$. This move into quantum mechanics is followed by, among other things, a discussion of the Groenwald–van Hove theorem, saying that there is no way of extending the metaplectic representation to include any non-quadratic polynomial. It is a great service to the public to treat this subject so completely in this book.

Maxwell's equations do appear at the end of Chapter I, but only to treat the motion of a charged particle in an electromagnetic field as being Hamiltonian with respect to a symplectic form on the cotangent bundle, which differs from the standard one by a "magnetic term".

Chapter I is concluded with the provoking question "Why symplectic geometry?" I would like to add to their answer that classical mechanics not