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20. L. Mansinha, D. E. Smylie, and A. E. Beck, *Earthquake Displacement Fields and the Rotation of the Earth, A NATO Advanced Study Institute Conference Organized by the Department of Geophysics, University of Western Ontario, London, Canada, June 22–28, 1969*. 1970, XI + 308 pp.
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## The Nature of Symbiotic Stars

*Proceedings of IAU Colloquium No. 70, held at the Observatoire de  
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Many aspects of symbiotic stars have long puzzled astronomers. While most students of the subject have considered them binary, many have at different times supported single star models. The nature of their outbursts is uncertain, while the dividing line between symbiotic stars and novae is unclear. As Friedjung himself points out, doubts can even be raised as to whether a class of 'symbiotic stars' really exists.

This is therefore, a very timely book, covering as it does the proceedings of the first international conference devoted exclusively to a limited field that has been the source of many heated debates. It deals with recent results which are having profound effects on the development of the subject, discussing observations in all spectral regions. This is followed by a detailed consideration of specific stars, taking into account that the stars differ from each other and it is not clear whether they all have the same physics. Their classification and the interpretation of the observations in binary and other model frameworks are then considered, leaving until the end examination of the significance of these stars within the pattern of stellar observation.

### *Audience*

The book will be of particular interest to astronomers concerned with stellar atmospheres, the interpretation of space observations, close binaries and cataclysmic variables, and stellar structure and evolution.



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