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Long-term Datasets for the Understanding of Solar and Stellar Magnetic Cycles

Edited by

Dipankar Banerjee

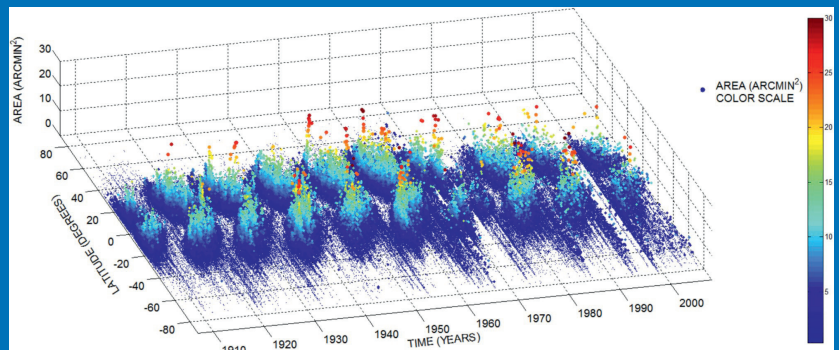
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LONG-TERM DATASETS FOR THE UNDERSTANDING
OF SOLAR AND STELLAR MAGNETIC CYCLES

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COVER ILLUSTRATION:

Time-latitude map of individual plage areas, visualised in three dimension as revealed from 100 years of Kodaikanal data. Minimum to maximum plage area range is defined by dark blue to dark red through green, yellow and orange as indicated by the color scale. The data is available at <https://kso.iiap.res.in/> (image courtesy: Chatterjee *et al.* 2016, ApJ, 827, 87).

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**LONG-TERM DATASETS FOR
THE UNDERSTANDING OF
SOLAR AND STELLAR
MAGNETIC CYCLES**

**PROCEEDINGS OF THE 340th SYMPOSIUM
OF THE INTERNATIONAL ASTRONOMICAL
UNION HELD IN JAIPUR, INDIA
FEBRUARY 19–23, 2018**

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Preface

Solar variations have significant influence on the Earth's space environment and climate via its magnetic field, irradiation and energetic particles. Long-term and reliable historical datasets of solar and stellar activity indices are crucial for understanding the variations and predicting the future solar cycle. Cosmogenic and radionuclides can extend our knowledge of solar variations back to the Holocene. There are a number of important and hot issues relevant to the evolution of solar activity and variability. These include, how to build up long-term consistent datasets, e.g., sunspot number and solar irradiance, how to realistically reconstruct the physics parameters, e.g., interior convection spectrum and photospheric open flux, based on the records, how to understand the relations among different indices, how to model the solar cycles based on the observed data. Furthermore, the progress in the understanding of the stellar variability and activity cycles helps us to understand the solar cycle over a much wider sample of parameters.

This symposium brought together scientists from diverse, interdisciplinary areas such as solar, stellar, space and heliospheric physics to review the status of the different long-term datasets available across the globe. It provided a platform to exchange ideas on the understanding of solar long-term behavior, its effects and predictions. The Kodaikanal Observatory has observed the sun at wavelengths WL, Ca-II K, H-alpha since 1904. The digitization process has been completed recently and data has been made available to the global community. The calibrated data was formally opened to the global community through an announcement during the conference. IAU Symposium 340 enabled a comparison of recent results from a wide variety of scientific disciplines, which includes

- Helio/asteroseismology long-term data: solar/stellar interior velocity fields – Status, divergence, and challenges
- Long term magnetic field measurements in the sun and stars
- Sunspot number datasets: status, divergences, and unification
- Solar total irradiance and spectral irradiance long-term data: status, divergences, and challenges
- Solar cycle database of solar activity: variations in solar eruptions (flares, CMEs, SEPs, etc.)
- Long-term monitoring of stellar activity: lessons for the solar cycle
- The variable solar wind and the heliosphere
- Solar behavior over centuries using radioisotopes
- Physical causes of the solar/stellar cycle irregularities
- From past to future: predicting upcoming solar cycle 25

There were eight sessions with 25 invited talks and 46 contributed presentations. There were 153 poster presentations and dedicated poster sessions were allotted each day. Each session also attracted poster awards for young scientists. A total number of 233 registered participants attended the symposium, with 157 male and 69 female candidates from 26 different countries across the globe. All the presentation files are now posted at the conference website at <https://www.iap.res.in/iaus340/Home>. This proceeding is only a selection of the presentations delivered at IAUS340 and serves an account of the Symposium. The articles are organized according to the subject areas as listed above.

There were several education and outreach programs conducted during the conference, including a visit for the conference delegates to the Jantar Mantar, a world heritage site. There were workshops organized for the tourist guides with the theme of understanding the usage of the historical observatory instruments through Positional Astronomy

observations. A full day workshop on computer based data analysis on long-term solar data sets was also organized for undergraduate and graduate students on the last day of the conference. 90 students attended this workshop. Nat Gopalswamy delivered a public lecture titled “Our life-giving star, the Sun and its dark side” in one of the evenings.

We are grateful to the SOC for a wonderful scientific program, to the LOC for their tireless work for the preparation and execution of the meeting. It is a great pleasure to acknowledge the support of the sponsors listed on page xvi. We also express our gratitude to the IAU for the continuous support and encouragement, with particular mention of Prof. Teresa Lago, Assistant General Secretary of the IAU.

Last but not least, we would like to thank all the attendees for their patience, consideration and active participation.

Dipankar Banerjee
Indian Institute of Astrophysics
(On behalf of the Editors, SOC & LOC)

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