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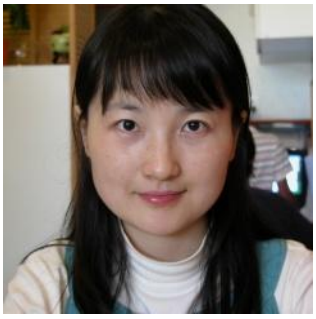
# 国台学术报告 NAOC COLLOQUIUM

## 2012 年 第 46 次 / Number 46, 2012

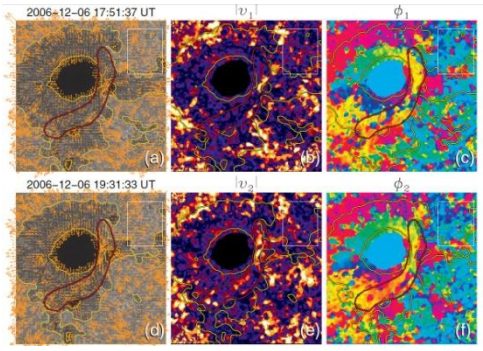
**TIME: Thursday, 10:00 AM, Sep 06, 2012 LOCATION: A601 NAOC**

# The impact of flares on sunspot structure and flow



**Dr. Na Deng (California State University)**

Dr. Na Deng is a Research Professor of Space Weather Research Laboratory, New Jersey Institute of Technology (NJIT). She obtained her Ph.D. from NJIT in 2007. After which she did a 4-year post doc in Physics & Astronomy Department, California State University Northridge. Her main research interests includes spectroscopic study of solar magnetic fields and flow fields in both photosphere and chromospheres, rapid change of sunspot structure and magnetic fields associated with flares/CMEs, flow fields in active regions and their evolution with flares/CMEs, image reconstruction techniques and fine structures in solar active regions and coordinated analysis of data from space- and ground-based instruments.




## Abstract

Sunspot structure can change rapidly right after major flares, which was originally revealed by TRACE white-light observations. The changes include two aspects: (1) pieces of penumbra in the outer region of δ sunspots suddenly disappear, (2) meanwhile the central sunspot features near the flared Polarity Inversion Line (PIL) is darkened.With Hinode/SOT observations covering major flares, we characterized the flare-induced sunspot change in high resolution accommodating uncombed penumbral model. We found that in sections of peripheral penumbrae swept by flare ribbons, the dark penumbral fibrils completely disappear, while the bright penumbral grains evolve into faculae that are signatures of vertical magnetic flux tubes. These observations suggest that the original uncombed magnetic structure seems to be combed toward the vertical direction, which results in the rapid transition of peripheral penumbrae to faculae. We also examined the evolution of the central penumbra in the flaring PIL region with Hinode/SOT observations that cover the X6.5 flare on 2006 December 6 in NOAA 10930. We observed highly sheared penumbra in between the positive and negative umbrae. By applying the LCT technique to the foreshortening-corrected G-band image series, we detected prominent enhancement of the sheared Evershed flow in the central penumbra right after the flare. The increased horizontal Evershed flows imply increased horizontal magnetic field that contributes to the dark penumbral fibrils thus the overall darkening of the penumbra in the flared PIL region. Recent SDO/HMI observations provide solid evidence for the rapid and permanent change of photospheric vector magnetic fields in the flared δ sunspots, especially the increase of horizontal field in the PIL region. The derived Lorentz force changes show a downward and upward pulse in the central and peripheral regions, respectively. This is consistent with sunspot structure change and the flare's implosion scenario.

*All are welcome! Tea, coffee, biscuits will be served at 9:45 A.M.*

You are welcome to nominate speakers to Shude Mao (shude.mao@gmail.com), Licai Deng (licai@bao.ac.cn), Xuelei Chen (xuelei@cosmology.bao.ac.cn).