Emerging dimmings of active regions observed by the Solar Dynamics Observatory

Jun Zhang*[1], Shuhong Yang[1], Yang Liu[2], and Xudong Sun[2]

[1]Key Laboratory of Solar Activity, National Astronomical Observatories, Chinese Academy of Sciences – 20A Datun Road, Chaoyang District, Beijing, China

[2]W.W. Hansen Experimental Physics Laboratory, Stanford University – Stanford, CA 94305-4085, USA, United States

Abstract

Using the observations from the Atmospheric Imaging Assembly and the Helioseismic and Magnetic Imager on
board the Solar Dynamics Observatory, we statistically investigate the emerging dimmings (EDs) of 24 isolated
active regions (IARs) from 2010 June to 2011 May. All the IARs show EDs in lower-temperature lines (e.g.,
171 Å) at their early emerging stages.Meanwhile, in higher temperature lines (e.g., 211 Å), the ED regions brighten
continuously. There are two types of EDs: fan-shaped and halo-shaped. There are 19 fan-shaped EDs and 5 haloshaped
ones. The EDs appear to be delayed by several to more than ten hours relative to the first emergence of
the IARs. The shortest delay is 3.6 hr and the longest is 19.0 hr. The EDs last from 3.3 hr to 14.2 hr, with a mean
duration of 8.3 hr. Before the appearance of the EDs, the emergence rate of the magnetic flux of the IARs is between
1.2× 10ˆ19 Mx/hr to 1.4 × 10ˆ20 Mx/hr. The larger the emergence rate is, the shorter the delay time is. While the
dimmings appear, the magnetic flux of the IARs ranges from 8.8 × 10ˆ19 Mx to 1.3 × 10ˆ21 Mx. These observations
imply that the reconfiguration of the coronal magnetic fields due to reconnection between the newly emerging flux
and the surrounding existing fields results in a new thermal distribution which leads to a dimming for the cooler
channel (171 Å) and brightening in the warmer channels.

Keywords: Sun: activity – Sun: atmosphere – Sun: photosphere – Sun: surface magnetism

*Speaker