

Statistical Study of Umbral Dots

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Umbral dots are tiny bright points (less than 1000km) observed in a sunspot umbra. They are important for understanding the energy transport in sunspots, because radiative transport alone is insufficient to account for the observed umbral brightness. One of the most promising theory is that umbral dots are a manifestation of magnetoconvection in a narrow region, which is compressed by strong magnetic field (Weiss et al. 2002, Shussler & Vogler 2006).

A high resolution imaging observation of a sunspot umbra was made with Hinode Solar Optical Telescope. We performed a statistical study of lifetime, size, proper motion, and temperature of umbral dots. Also using Hinode Spectro-polarimeter, we could derive magnetic field and Doppler velocity field around umbral dots.

There is another interesting phenomenon about the brightness of umbral dots. Thanks to the stable and high cadence observation, we found an oscillatory pattern in their peak brightness.

The oscillation can be interpreted by a superposition of short-term (~15 minutes) and long-term (~50 minutes) components.

Considering all the derived properties, we try to discuss the validity of magnetoconvection model of umbral dots.