



Supersonic Downflows at the Umbra-Penumbra Boundary of Sunspots

<http://www.firstlight.cn> 2010-10-04

High resolution spectropolarimetric observations of 3 sunspots taken with {\em Hinode} demonstrate the existence of supersonic downflows at or close to the umbra-penumbra boundary which have not been reported before. These downflows are confined to large patches, usually encompassing bright penumbral filaments, and have lifetimes of more than 14 hr. The presence of strong downflows in the center-side penumbra near the umbra rules out an association with the Evershed flow. Chromospheric filtergrams acquired close to the time of the spectropolarimetric measurements show large, strong, and long-lived brightenings in the neighborhood of the downflows. The photospheric intensity also exhibit persistent brightenings comparable to the quiet Sun. Interestingly, the orientation of the penumbral filaments at the site of the downflows is similar to that resulting from the reconnection process described by \cite{Rytova2008a}. The existence of such downflows in the inner penumbra represents a challenge for numerical models of sunspots because they have to explain them in terms of physical processes likely affecting the chromosphere.

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