

## **Granular scale magnetic flux cancellations in the photosphere**

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**Abstract.** The net magnetic flux increases or decreases on the solar surface, depending on whether like-polarity or opposite-polarity magnetic elements have merged. The magnetic flux cancellation is a descriptive term to indicate a mutual flux loss due to the apparent collision of the opposite-polarity magnetic elements. This flux cancellation is essential to the process of replacement of old magnetic flux with newly emerging flux in the quiet Sun on a timescale of a few days, and also to the process of removal of sunspot magnetic flux from the photosphere. We investigate the evolution of 5 granular-scale flux cancellations observed at the high spatial resolution of the Hinode/SOT. These cancellation events occur in the quiet-area just outside an active region. Our observations clearly show that the opposite-polarity magnetic elements approach a junction of the intergranular lanes and then they collide with each other there. The intergranular junction has Doppler red shifts, darker intensities than the regular intergranular lanes, and surface converging flows. We find that the horizontal magnetic field appears between the canceling elements in only one event. The horizontal fields are observed along the intergranular lanes with red shifts. This cancellation is most probably a result of the submergence of low-lying photospheric magnetic flux. In the other 4 events, the horizontal field is not observed between the opposite-polarity magnetic elements at any time when they approach and cancel each other. These canceling elements have nearly vertical fields even while they are in contact each other. These events are more interesting because in the usual idea of the submergence of a low lying inverted U-loop or the buoyant rise of a U-loop, the appearance of a horizontal field is the observational signature of the loop top (or bottom) passing across the photosphere. In the case of flux cancellations without the appearance of the horizontal field, there is the possibility that the actual flux cancellation rapidly takes place near the solar surface in the local area at scales less than the 200km resolution of the Hinode/SOT.