Space Science Seminar
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Sunspot Penumbral Jets: Magnetic Setting, Coronal Emission and Twisting

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Penumbral jets are narrow, transient, bright events in the chromosphere of sunspot penumbrae. These were proposed to form as a result of magnetic reconnection between two components of magnetic field, known as penumbral spines and interspines, inclined at an acute angle with each other. Based on the recently explored small-scale structure of sunspot penumbrae, we propose a modified formation mechanism of penumbral jets, in that the reconnection takes place between the spine field and the opposite-polarity field at the edges of penumbral filaments. An estimation of thermal energy of penumbral jets, based on their sizes and temperatures, returns values of the order of that of nano-flares, thus suggesting that penumbral jets might be potential contributors to transition-region and coronal heating in sunspots. By using Hinode, AIA and Hi-C data, we find that only large jets, produced repeatedly at the same locations, show their signatures directly in transition-region lines (e.g., in AIA 1600, 304, 171, and 193 Å channels). Even these large jets could not be detected in AIA 94 Å; thus, whether they have any coronal-temperature plasma remains unclear. These are observed to have mixed-polarity flux in Stokes-V images from SOT/FG, and appear to be at the tails of penumbral filaments, or at the locations where tails of several filaments converge. We further use IRIS (Mg II k 2796 Å slit jaw images and spectra) and magnetograms from Hinode SOT/FG to examine large penumbral jets in another sunspot near disk center, and find indications that they spin, thus, indicating that large penumbral jets might be driven the same way as X-ray jets and CMEs, by the eruption of a magnetic arcade carrying a twisted flux rope inside.

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