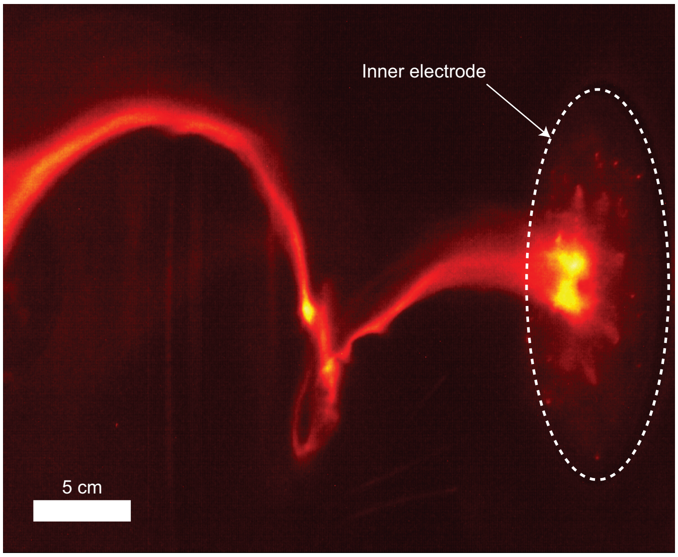
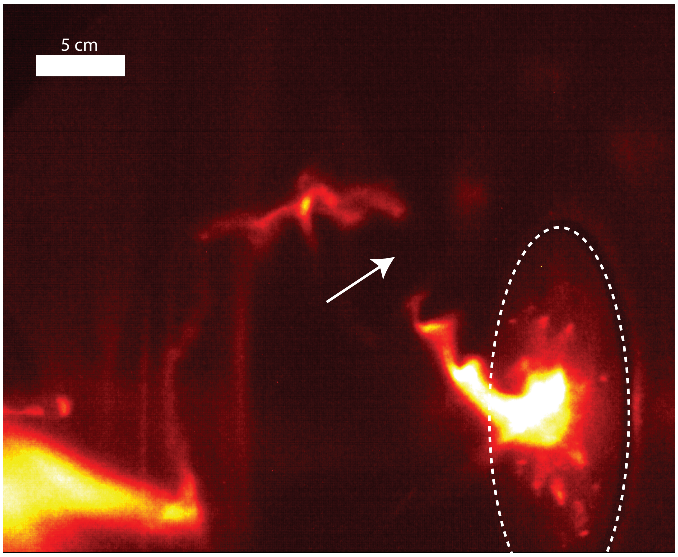
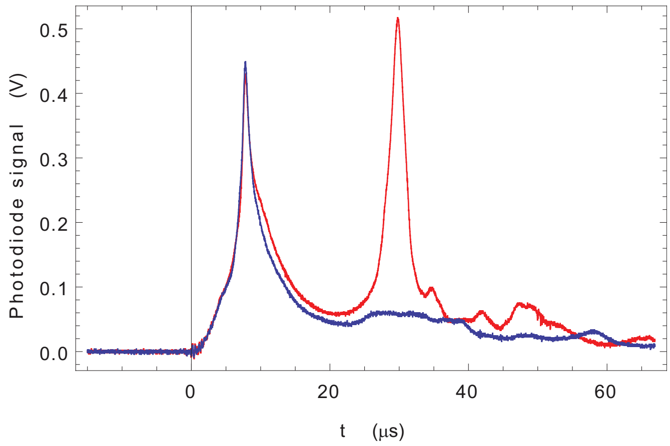
doi:10.1038/nature10827



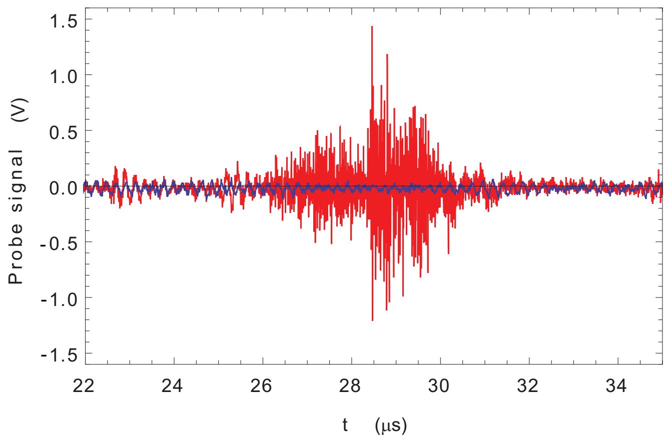
SI Figure 1: Three-dimensional helical structure of the kink instability. The helix is right-handed; that is, the portion of the filament on the left-hand side of the image is in the foreground and the portion of the filament connected to the electrode on the right-hand side of the image is in the background. In this case the argon plasma filament shows the beginning of fine structure associated with the Rayleigh–Taylor instability. Shot no. 11,037; image intensity is logarithmically scaled and false colored.



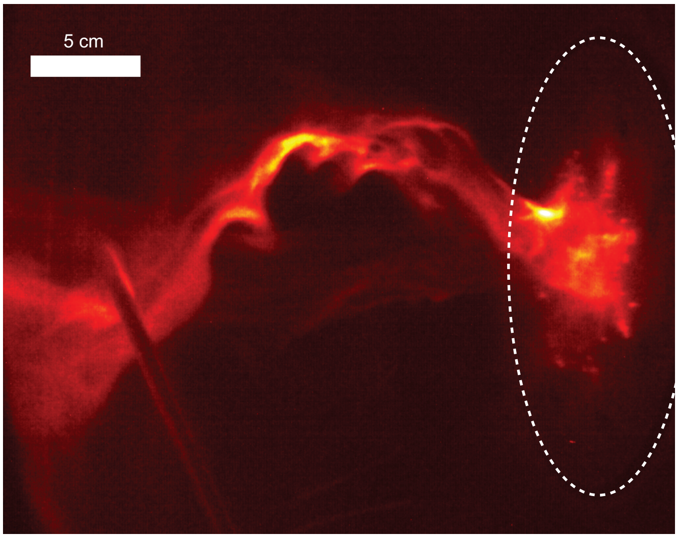
SI Figure 2: Plasma filament breaks and reconnects. An argon plasma jet reconnects after the kink instability and Rayleigh–Taylor instability. The filament snapped; the portion of the filament still connected to the electrode on the right-hand side of the image accelerates downward. The Rayleigh–Taylor instability is on the trailing side of both the upward and downward accelerating portions. Shot no. 11,131; image intensity is logarithmically scaled and false colored.



SI Figure 3: Extreme-ultraviolet radiation burst at the time of reconnection. Figure shows photodiode data comparing the case with and without reconnection. The red trace, shot no. 11,042, is from an exponentially growing kink that undergoes a Rayleigh–Taylor instability and reconnects. The red trace shows a peak in emission centered at $\sim$30 μs, the corresponding fast camera image shows fine structure at 30 μs and that the plasma has reconnected by 32 μs. The blue trace, shot no. 11,044, is from a linearly growing kink, for comparison.



SI Figure 4: Electrostatic excitations at the time of reconnection. Figure shows capacitively coupled probe data comparing the case with and without reconnection. The red trace, shot no. 11,214, is from an exponentially growing kink that undergoes a Rayleigh–Taylor instability and reconnects. The signal is strongest at $\sim$29 μs; the corresponding fast camera images show fine structure beginning to form at 28 μs, growing at 29 μs and that the plasma has reconnected by 30 μs. The blue trace, shot no. 11,202, is from a linearly growing kink, for comparison. A Fourier transform of the red data shows that the frequency of excitation is $\sim$30 MHz. The argon plasma has a density of $\sim 10^{22}$ m^{-3}, and in shot no. 11,214 a magnetic probe array measured the magnetic field to be $B = 0.2$ T; these values put this frequency of oscillation in the whistler wave regime.



SI Figure 5: Hydrogen plasma does not reach microscale. A hydrogen plasma jet kinks and then develops a Rayleigh–Taylor instability. The Rayleigh–Taylor instability does not erode the plasma filament sufficiently for magnetic reconnection to take place because the ion skin depth is $c/\omega_{pi} \approx 0.2$ cm whereas the filament diameter is 0.8–1 cm at its thinnest point. Shot no. 11,574; image intensity is logarithmically scaled and false colored.