Abstract Submitted
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Magnetic Flux Ropes, Reconnection and Chaotic Fields and Flows[1] WALTER GEKELMAN, Dept. Physics University of California, Los Angeles — Many systems in nature become chaotic when a threshold is crossed. Magnetic Flux Ropes are no exception. Magnetic field lines and plasma flows can become chaotic during reconnection. The ropes which are formed in a magnetized background plasma are kink unstable, twist, writhe and collide as they kink. Three dimensional magnetic fields and flows are measured at thousands of time steps and up to 50,000 spatial locations. The field lines are computed by conditionally averaging the data; when chaos sets-in, many "shots" are rejected by the averaging processes. This results in what is most interesting but cannot be seen. Recently, mathematical tools have been developed to identify chaotic dynamics. Permutation entropy can be calculated from measured time series and used to calculate a position on a Jensen-Shannon complexity (C-H) plane[1]. The location of data points on this plane indicates if the magnetic fields are stochastic, or fall into regions of minimal or maximal complexity. Various chaotic dynamical models provide a proxy for the chaotic region in this plane. The behavior of the flux ropes falls in the region of the C-H plane where chaotic systems lie. The entropy and complexity change in space and time, which reflects the type of dynamics associated with the ropes. C-H plane identification process has also been used in the study of temperature filaments[2] and can be applied to spacecraft, solar or fusion data. Other examples will be shown. [1] O. Russo et al., Phys. Rev. Lett., 99, 154102 (2007),[2] J. Maggs, G.Morales, Plasma Phys Contr. Fusion 55, 085015 (2013)

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