On the polytropic index of electrons in Flux-Ropes and a few consequences of the constitutive properties of this very dilute matter

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For a case study, the flux-rope (FR) that passed Earth on June 2, 2014(1) (see also listing of magnetic clouds and their properties in the Wind SC MFI science team site at http://wind.gsfc.nasa.gov/mfi/mag_cloud_S1.html), we proceed to interpret plasma and magnetic field observations in the context of MHD. The observations used are 3s average interplanetary magnetic field (Wind/MFI instrument) and 3s plasma (Wind/SWE instruments) data(2). After identifying the observed correlation between electron density, temperature and pressure in the plasma frame of reference we proceed to establish the existence of a relationship between these plasma observables with the magnetic field pressure. By assuming ideal MHD conditions to be valid we proceed to confirm that the medium is diamagnetic, as is to be expected for the MHD state of matter and magnetic field which is assumed to be a superconducting medium. Additionally we infer the presence of magnetization work, as well as a few other constitutive properties of this state of matter.

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2. Lepping R. P. et al, A summary of Wind magnetic clouds for years 1995 – 2003: model-fitted parameters, associated errors and classifications, Ann. Geophysicae, 24, 215-245, 2006.2006

3 Ogilvie, K. W., et al, SWE, A comprehensive plasma instrument for the Wind spacecraft, Space Sci. Rev., 71, 55 – 77, 1995; Lepping R.P., et al , The Wind Magnetic Field Investigation, Space Sci. Rev.,71, 207 – 229, 1995.