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Diamagnetic effects at the temination shock

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With the two VOYAGER spacecraft presently flying at solar distances larger than 80 AU it not only becomes very interesting to study the changing particle environments, but also to study the behavior of the distant magnetic fields which are swept out with the solar wind. It is especially challenging to look for the predicted shock features of the magnetic fields which are expected at the solar wind termination shock. While classical MHD theories clearly predict a strong abrupt increase in the magnetic field magnitude at perpendicular MHD shocks, VOYAGER-1 either has recently not crossed the termination shock as claimed or it did not see the predicted field increase as stated by. To perhaps clarify on these open points, we here investigate the role of diamagnetism of the solar wind ions approaching the termination shock when becoming shocked there. As we shall show the magnetic field induction is influenced by the magnetic moments of the gyrating solar wind ions. The magnetic moment per unit volume thereby is determined by the ion pressure and influences the effective magnetic fields. On the basis of that we here derive new MHD shock relations which show that deviating from classical MHD shock expectations the magnetic field compression ratio for a perpendicular shock is different from the density compression ratio and actually is determined by the preshock Alfvénic and sonic solar wind Mach numbers. If these data are carefully taken into account it may become explainable why VOYAGER-1 in fact did cross the termination shock without seeing the expected magnetic field increase. Energetic neutral atoms (ENA's) originating from decharged pick-up ions beyond the termination shock, by their spectra could serve as messengers of these new features of the shock.