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Magnetic field depression in electron holes

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We analyze spikes of the electrostatic field observed by Van Allen Probes in the outer radiation belt. These spikes exhibit the classical signatures of electron holes, i.e. a positive hump of the electrostatic potential (depleted electron density) and a propagation velocity of the order of an electron thermal velocity. The characteristic amplitude, velocity and spatial scale of these electron holes are several tens of mV/m, several thousand of km/s and about several km, respectively. The unexpected feature is the magnetic field depression of about several tens of pT within the observed electron holes. We suggest that this depression is due to the diamagnetic current of an electron population trapped within the electron hole. We estimate that the trapped population has a density up to 50% of the background plasma density, a temperature of about hundreds of eV and a high temperature anisotropy, $T_\perp/T_\parallel \sim 3.5$. We argue that the observed electron holes could be generated due to the injection of the highly-anisotropic plasma into the outer radiation belts.