DIRECT RADIO PROBING AND INTERPRETATION OF THE SUN'S DENSITY PROFILE

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The Sun's electron number density profile $n_e(r)$ is not well measured and understood from the Sun's photosphere ($r = R_S$) to the solar wind (say, $r > 10\ R_S$), despite its great importance for solar physics. A powerful new technique is developed and applied to extract $n_e(r)$ directly from the time-varying frequency of coronal type III radio bursts, for the first time. Unexpectedly, wind-like regions with $n_e = A\ (r - R_S)^{-2}$ are common below $2R_S$, and coronal type III bursts often are almost linear in $1/f - t$ dynamic spectra. Indices lower and higher than 2 also occur, the former plausibly due to non-radial curved magnetic field lines. The profile $n_e = A\ (r - R_S)^{-2}$ is consistent with the coronal radio data, type III simulations, and previous models based on eclipse and coronagraph observations. It gives a first physical basis for the previous models. A simple interpretation is in terms of conical flow from localized sources close to the photosphere, plausibly corresponding to UV funnels. The results also imply that solar wind acceleration occurs where $2 < r/R_S < 10$.

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