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Observed Properties of the Solar Wind MARCIA NEUGEBAUER, University of Arizona — The earliest measurements of the solar wind fully supported Gene Parker's theory. The wind was persistent and nearly radial, its speed was hundreds of km/s, the density was as predicted, and, on average, the interplanetary magnetic field was consistent with an Archimedian spiral. The fastest wind, with speed > 700 km/s, traced back to Bartel's unipolar M regions rather than to the hotter active regions, and the highest densities could be explained by compression where the fast wind plowed into the slower wind in its path. But, even in the early data, there were mysteries, some of which are not yet completely resolved. Understanding the alpha particles has been a challenge. Their abundance is highly variable, in the fast wind their temperature is generally > 4 times the proton temperature, and, despite their greater mass, they flow away from the Sun faster than the protons. To complicate the picture further, the protons, alphas, and electrons all have complex, anisotropic distribution functions, often with double peaks. The expanding wind cools more slowly than adiabatically, suggesting a zoo of wave-particle interactions probably responsible for marginal stabilities of the particle distributions. The study of interplanetary waves and turbulence is an active field of research. Recent decades have also seen the study of ions heavier than alphas, including particles in the wind that did not originate at the Sun. Fifty years after Parker's landmark paper, solar-wind physics is still an active area of research.

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