The density and magnetic field decrease as the solar wind expands outward into the interplanetary space, thus leading to a parallel temperature anisotropy, where $T_\parallel > T_\perp$. Conversely, when the solar wind plasma encounters the Earth’s dayside magnetosphere, compression leads to the perpendicular temperature anisotropy, $T_\perp > T_\parallel$. The measured temperature anisotropy near the Sun and 1 AU indicates that the proton temperature anisotropy is much more mild than predicted by double adiabatic theory. Physical reasons for the observation remain poorly understood at present. It is known that for perpendicular temperature anisotropy electromagnetic ion-cyclotron (EMIC) and mirror instabilities are excited, while for parallel temperature anisotropy (where parallel proton temperature is greater than perpendicular temperature), both the parallel and oblique fire-hose instabilities are excited. In the present paper we discuss theoretical construction of the anisotropy-beta relation observed in the solar wind by means of quasilinear theories of EMIC and mirror instabilities for the case of perpendicular temperature anisotropy, and (parallel) fire-hose instability for the situation in which parallel temperature anisotropy is dominant. We shall compute saturated wave amplitudes corresponding to various unstable modes computed on the basis of quasilinear theory, and compare the outcome with the various anisotropy-beta relations published in the literature and from recent observations.

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