30500 nT to estimate B.

Analysis

This region of the magnetosphere is characterized by stably trapped plasma, and thus adiabatic invariants of the motion are well conserved. In the absence of wave-particle scattering or collisions, an ion will conserve its total energy as it convects through this region. If the time rate of change of the magnetic field is small enough, $dB/dt = 0$, we can use a scalar field, U, to describe the electrostatic potential energy. With these assumptions, the total ion energy can be written, $W = K.E. + P.E. = \mu B_m + qU$, where μ is the magnetic moment, the first adiabatic invariant; B_m is the mirror point magnetic field strength, which depends on J, the second adiabatic invariant; and q is the charge. If the field lines are equipotentials, then B_m depends only on K, where $K = J/\sqrt{2m\mu}$. Thus given a B and E field model and specifying μ, K determines the equipotentials for all spatially distinct trajectories in the inner magnetosphere /9/. These equipotentials can be further simplified by making a coordinate transformation. Since $dW/dt = 0$, we can write, $\partial U/\partial B(K) = -\mu/q$. So that if we use U,B(K) to label spatial coordinates, (mapping $r, \phi \rightarrow U, B$), then particle trajectories are straight lines whose slope depends only on the ratio of two constants /10/.

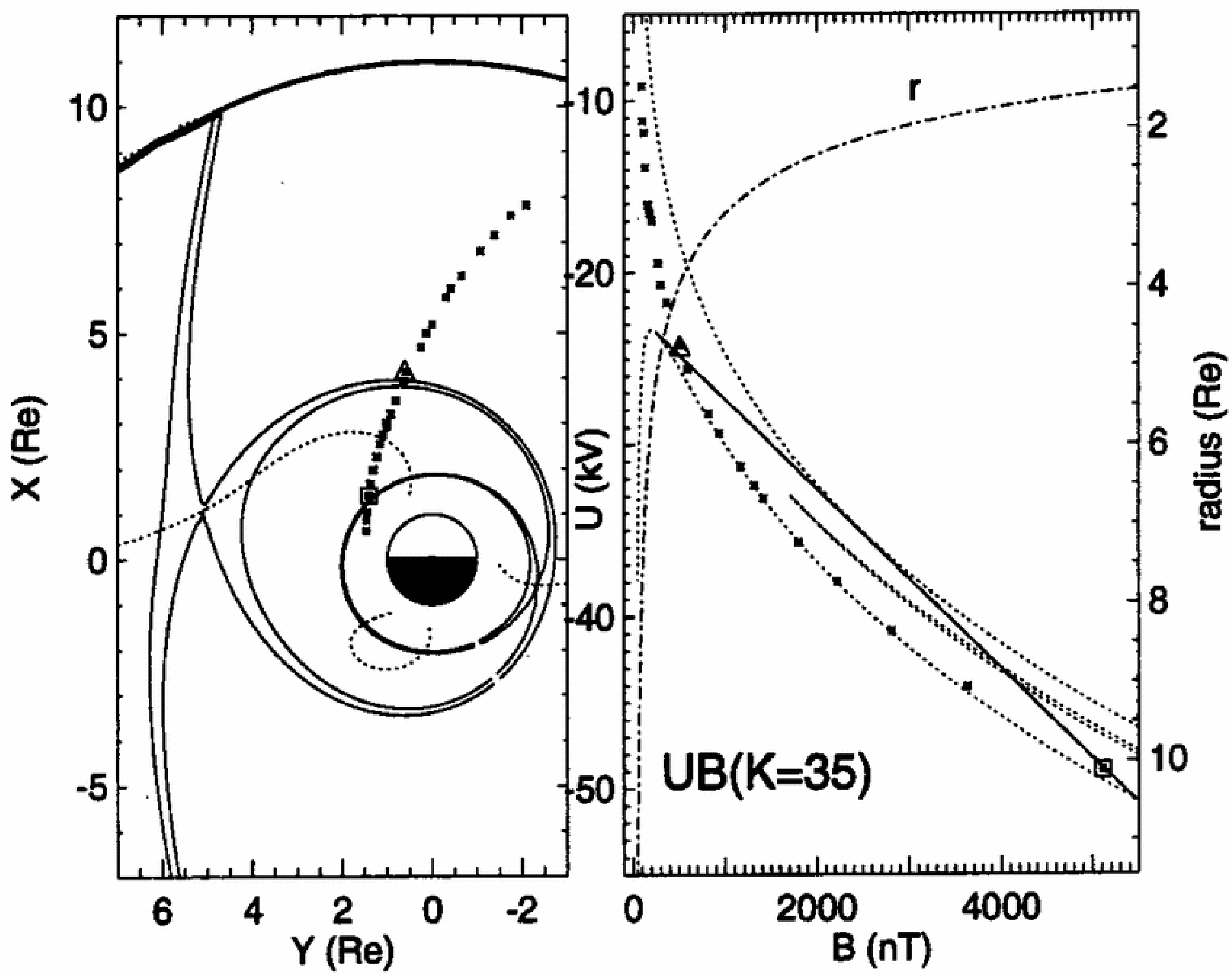

Fig. 1: 17 November 1977 ISEE-1 orbit shown in real space and UB(K=35) space with asterisks; solid line is ion drift trajectory; U,B tangency points shown dotted.

The mapping for the first orbit is shown in Figure 1, where we calculate trajectories for an Olson-Pfitzer /11/ magnetic field (standoff distance=10.5 R_E, D_{st}=-31) with a Volland-Stern + Richmond et al. /5/ electric field both in real space and transformed into UB(K) space. We have used a value of K=35 R_E-$\sqrt{nT}$, corresponding to an equatorial pitch angle of 66° at L=2. The Volland-Stern