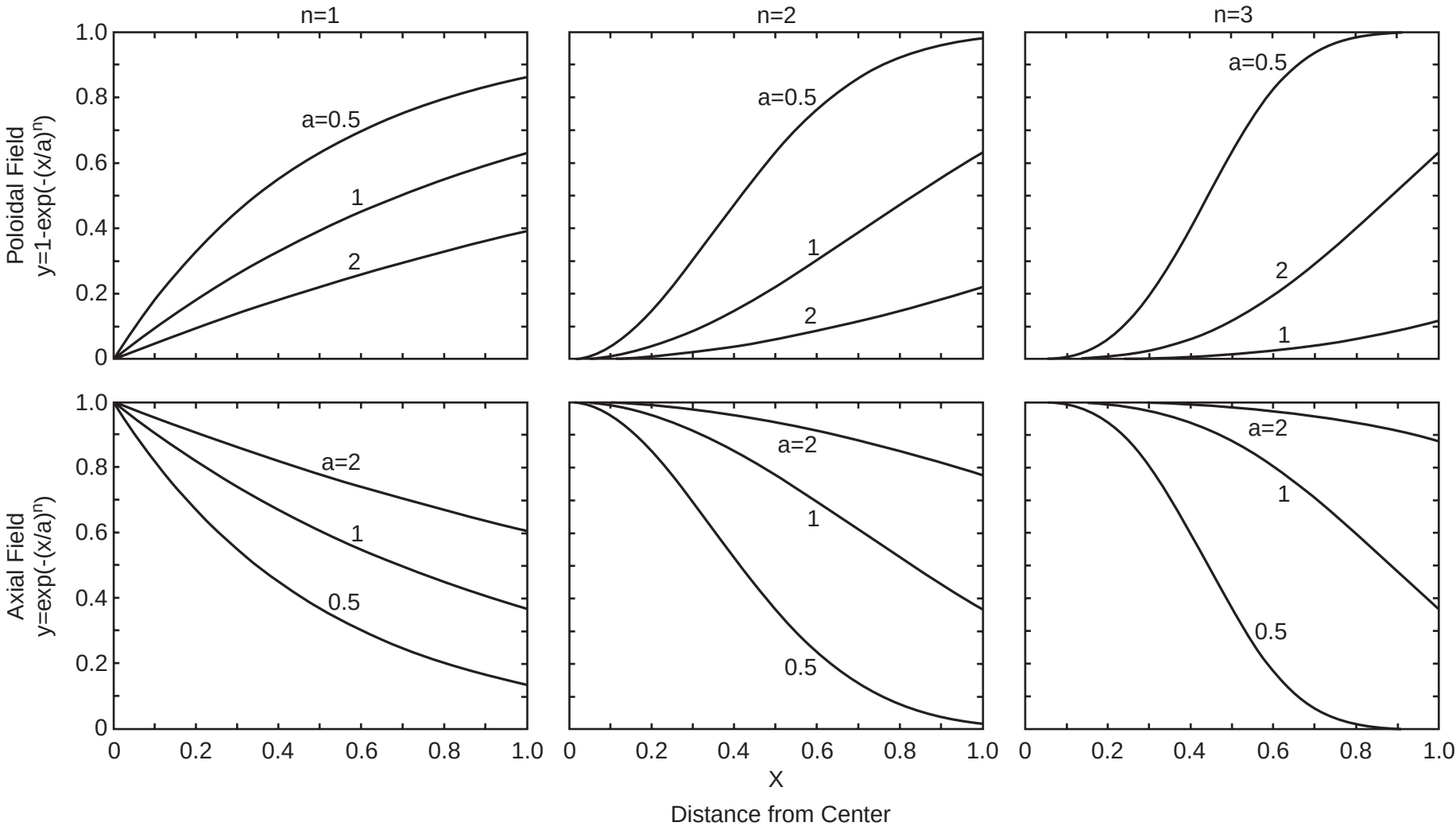


Figure 3. Poloidal and axial magnetic field components for non-force-free solutions using an exponential form of the model flux rope. The solution for different exponential powers and exponential scale lengths are shown.

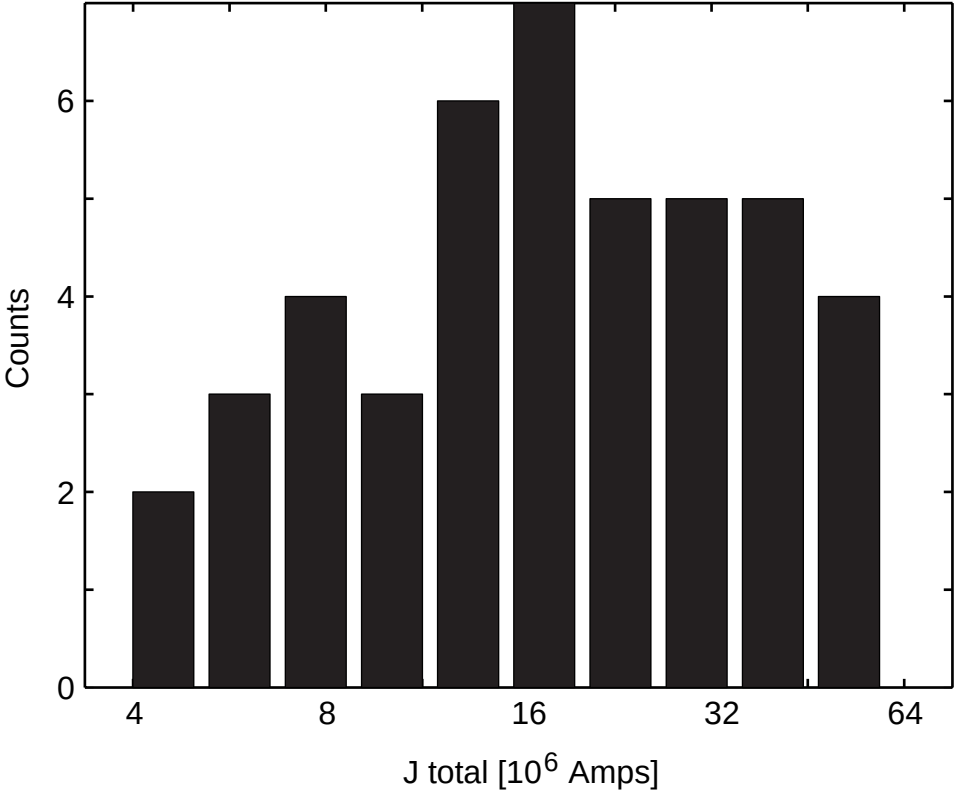


Figure 6. Number of flux ropes with different current.

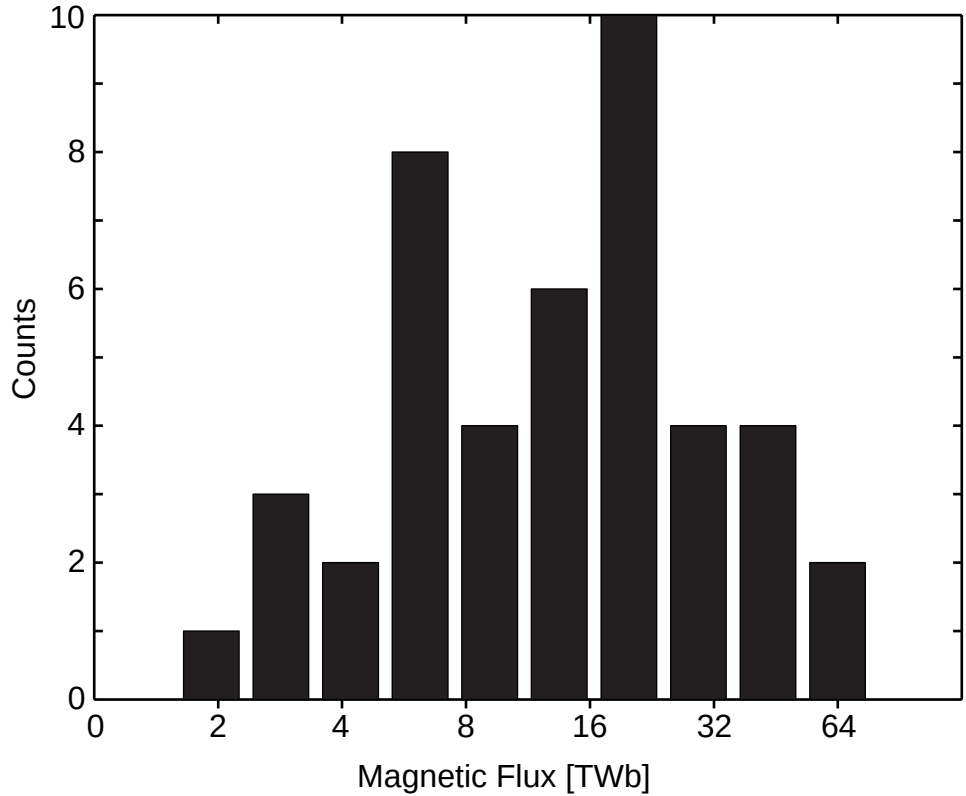


Figure 5. Number of flux ropes with different total integrated magnetic flux from the Pioneer Venus data set (1978-1988).

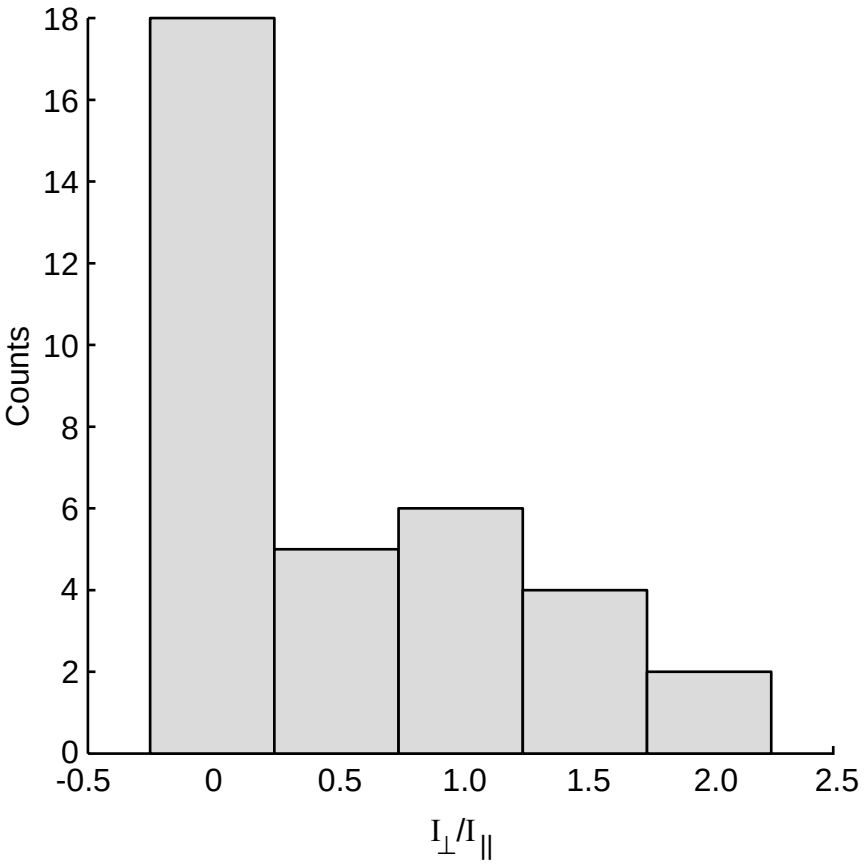


Figure 7. Number of cases with different ratios of perpendicular to parallel currents. The absolute value of the current has been taken so that currents associated with inward and outward forces cancel.

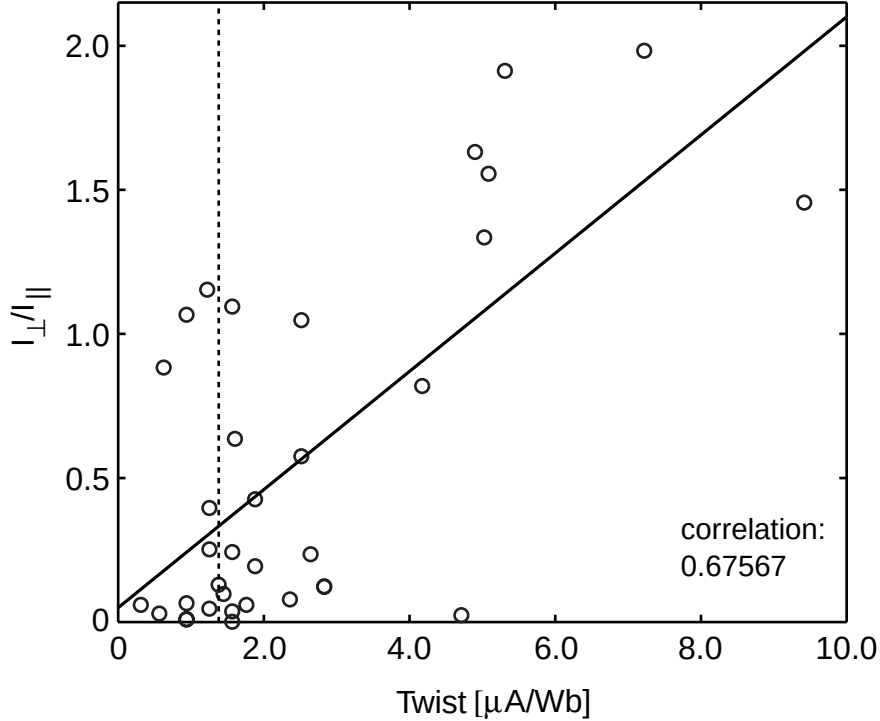


Figure 10. The ratio of the scalar perpendicular current to the parallel current versus the twist a. The Bessel function solution for a typical rope with an axial field of 20 nT and a radius of 0.1 AU would occur at the location of the vertical dashed line (but on the abscissa). The twist, (which may be force-free) and the radial force are correlated even though they need not be.

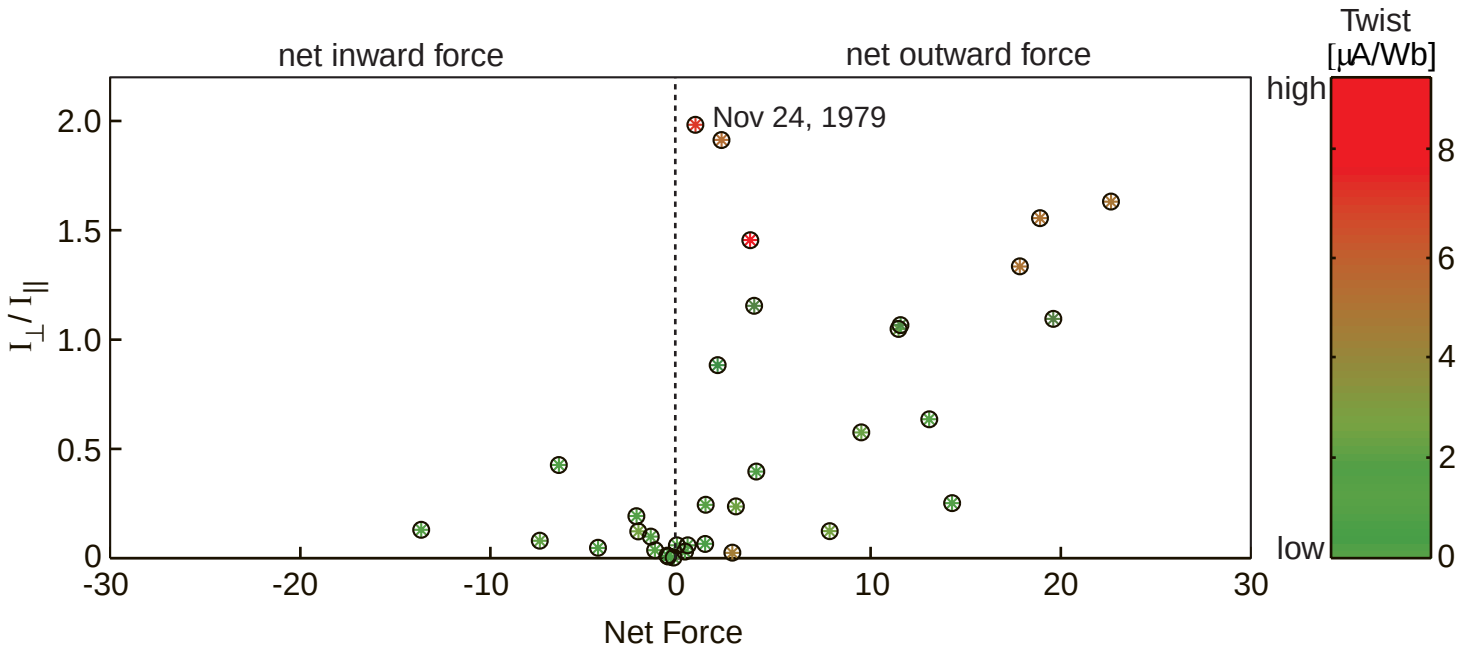


Figure 11. The ratio of the scalar perpendicular and parallel currents versus the net radial force. The ropes with low perpendicular currents have generally low net forces. When there is a net radial force, it is outward.

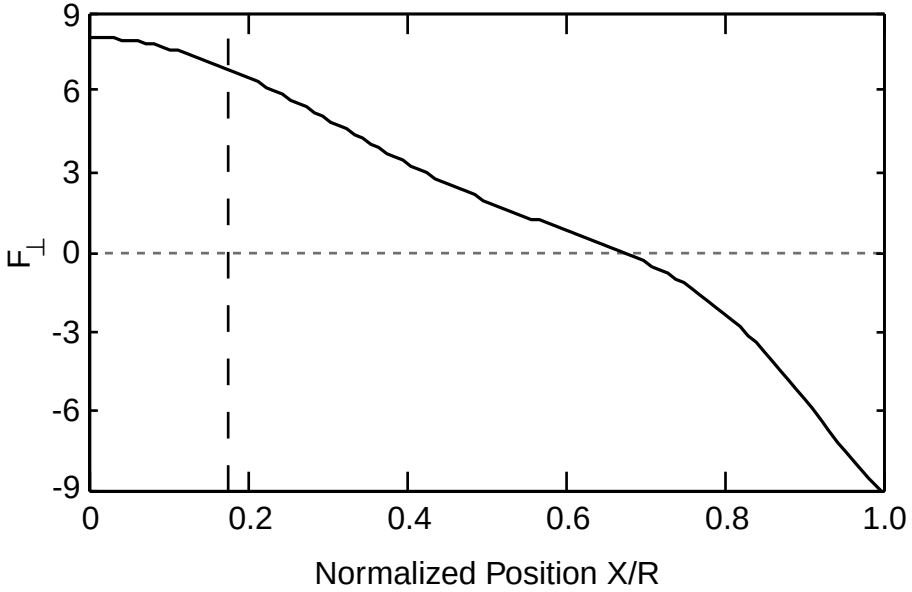


Figure 8. The perpendicular force (JxB) as a function of radius of a rope. The impact parameter is shown. No measurements were obtained to the left of this line. Positive forces are outward.

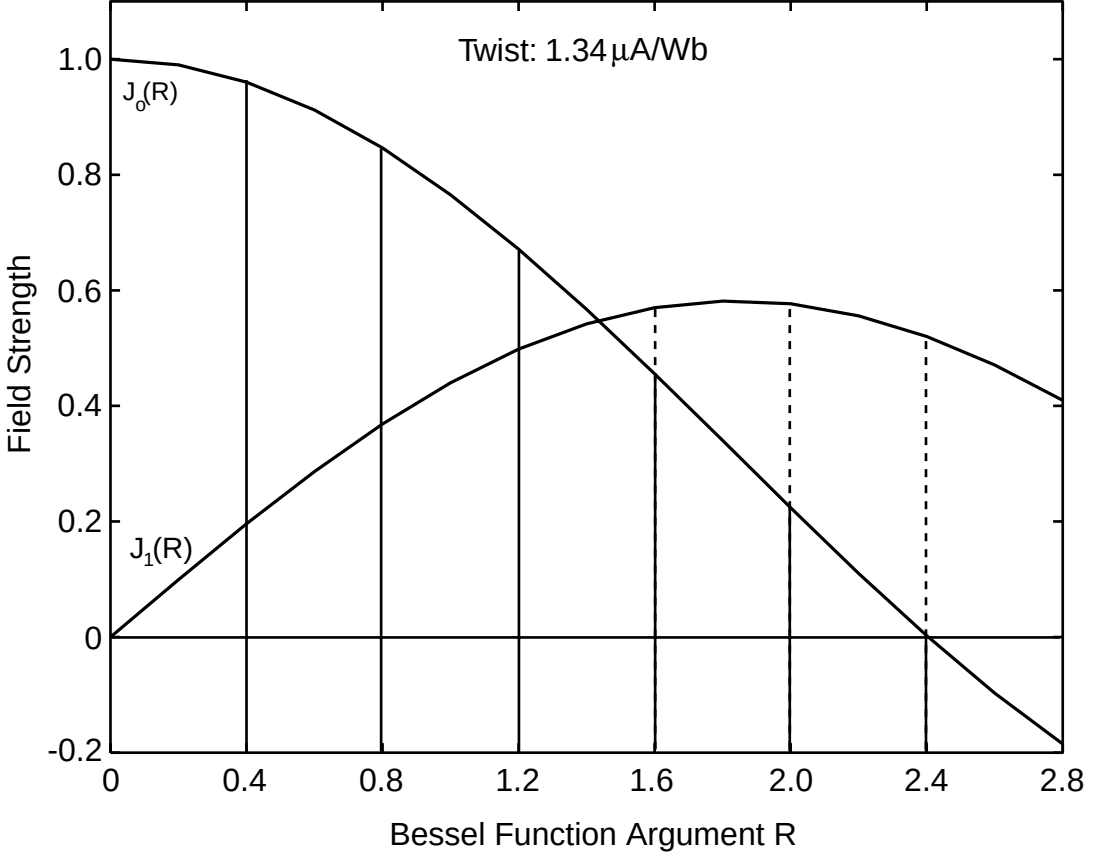


Figure 1. The axial and poloidal magnetic field components in the Bessel function, constant a solution (Taylor state). The only differences between solutions are the maximum field strength at the center of the rope and the radius of the rope, here taken to be 20 nT and 0.1 AU respectively, giving an a 1.34 m A/Wb. To fit a rope that has mainly axial field, one fits the interior section of the solution to the entire rope (e.g. from 0 to 0.4). To fit a rope that is highly wound around the axis one would use the entire rope out to a Bessel argument of 2.4.

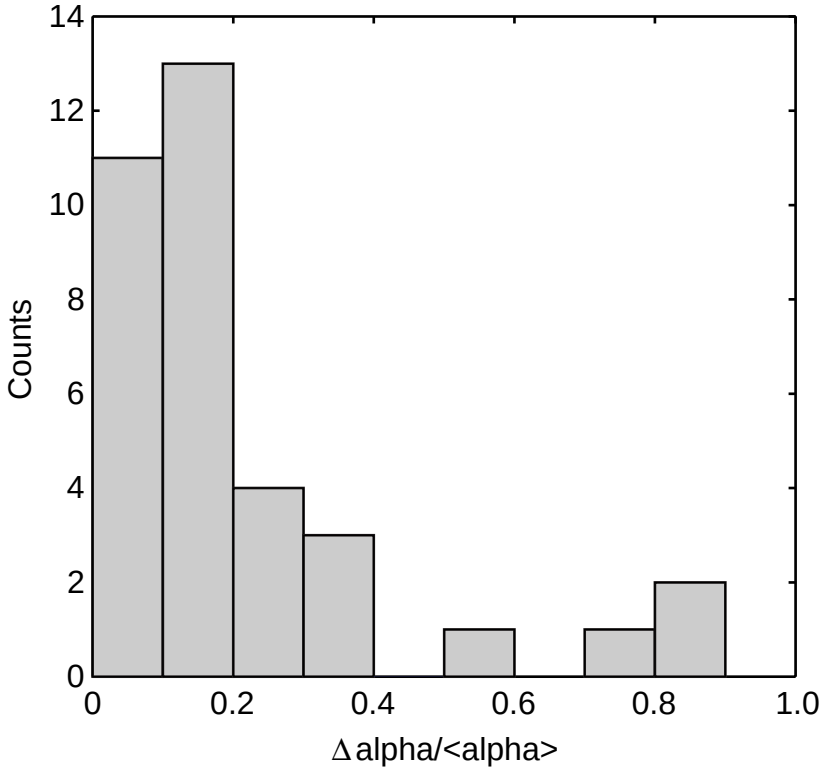


Figure 9. Demonstration of the variation of a in these now-force-free solutions. The maximum a minus the minimum a normalized by the average a. Ropes on the left are nearly force-free.

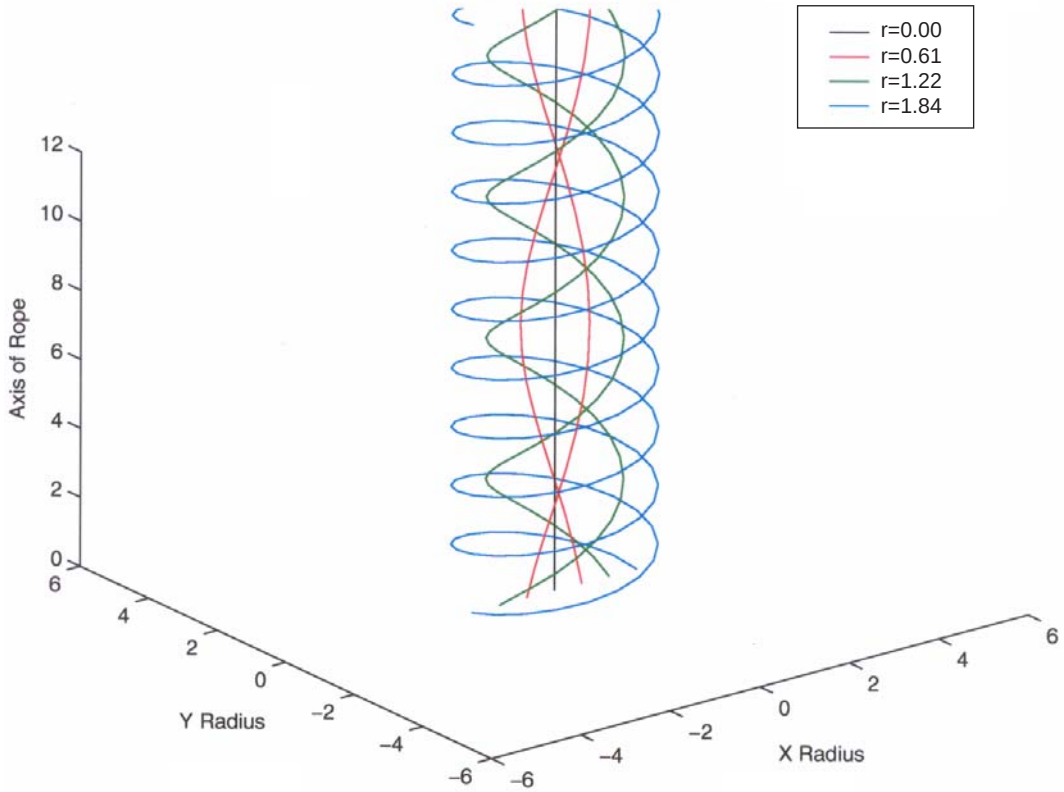
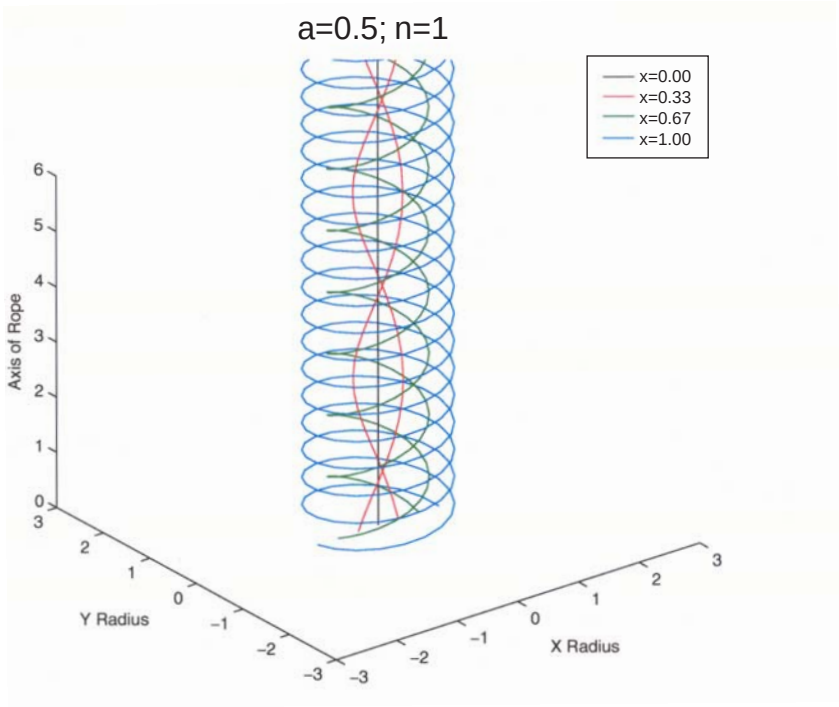
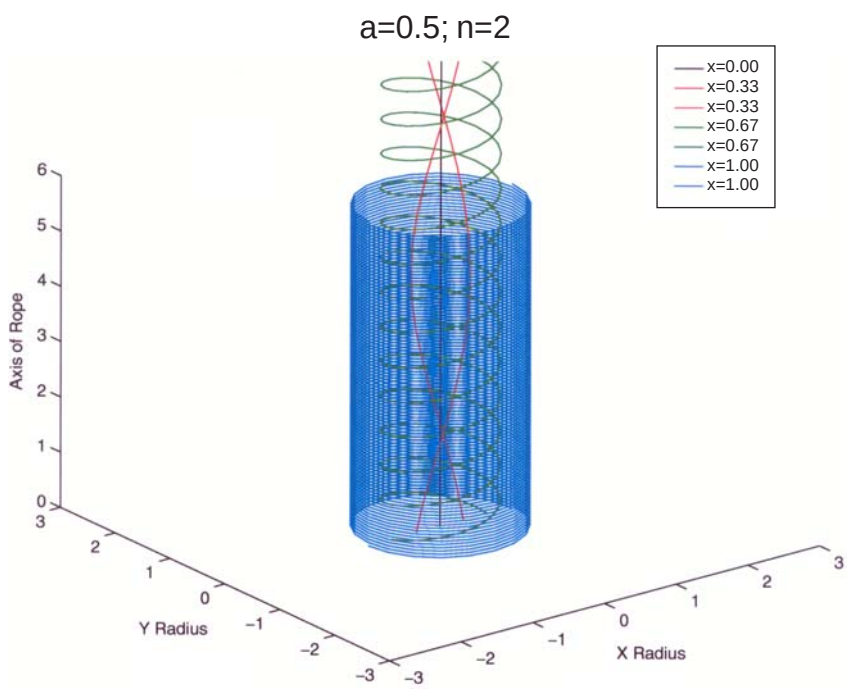
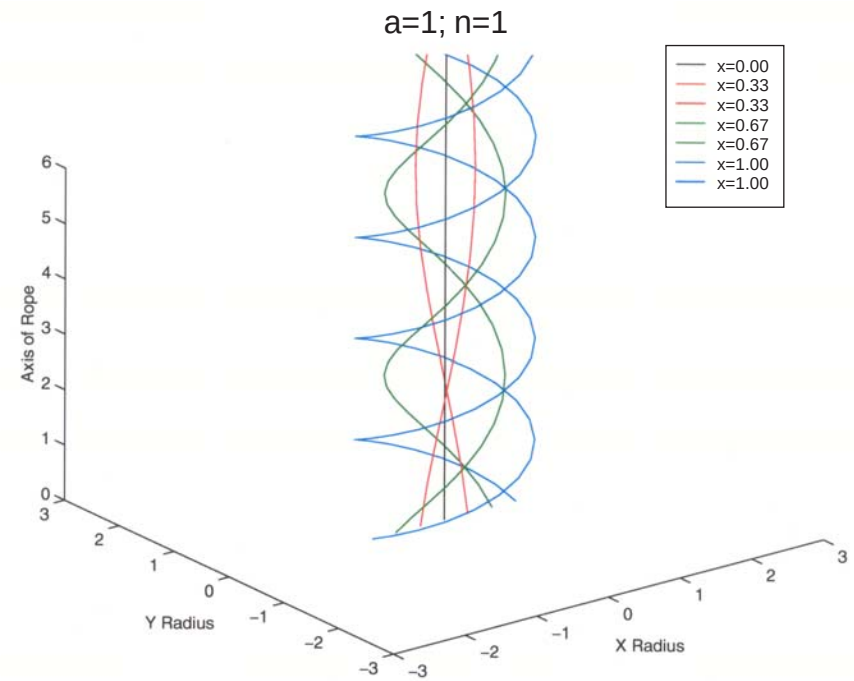


Figure 2. A constant alpha flux rope from the Bessel function solution.

Magnetic Flux Ropes with Exponential Field







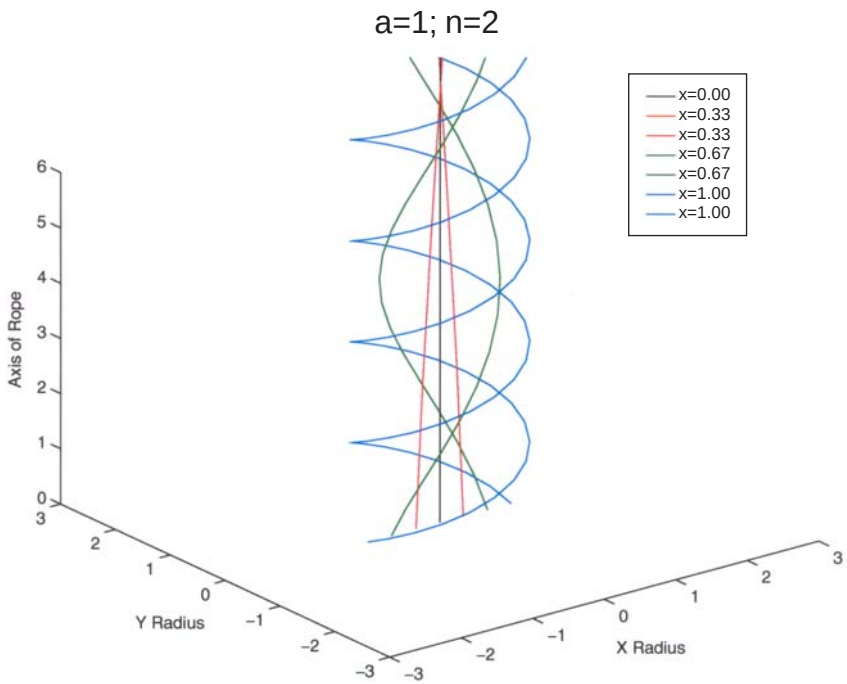


Figure 4. Four sample non-force-free flux ropes.