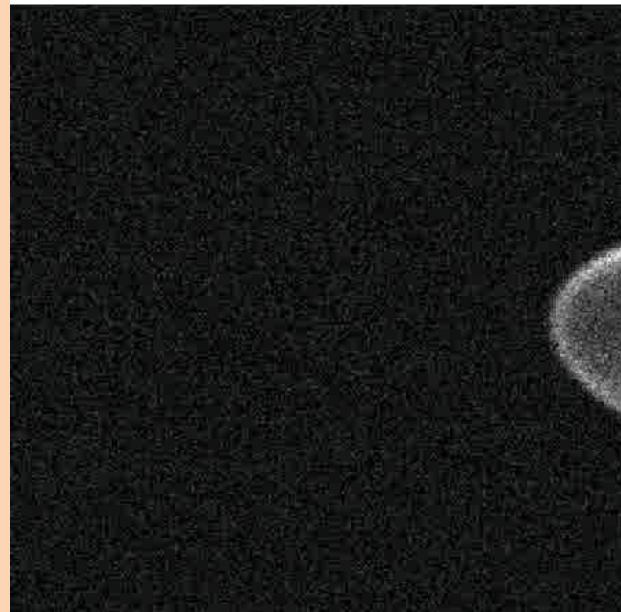
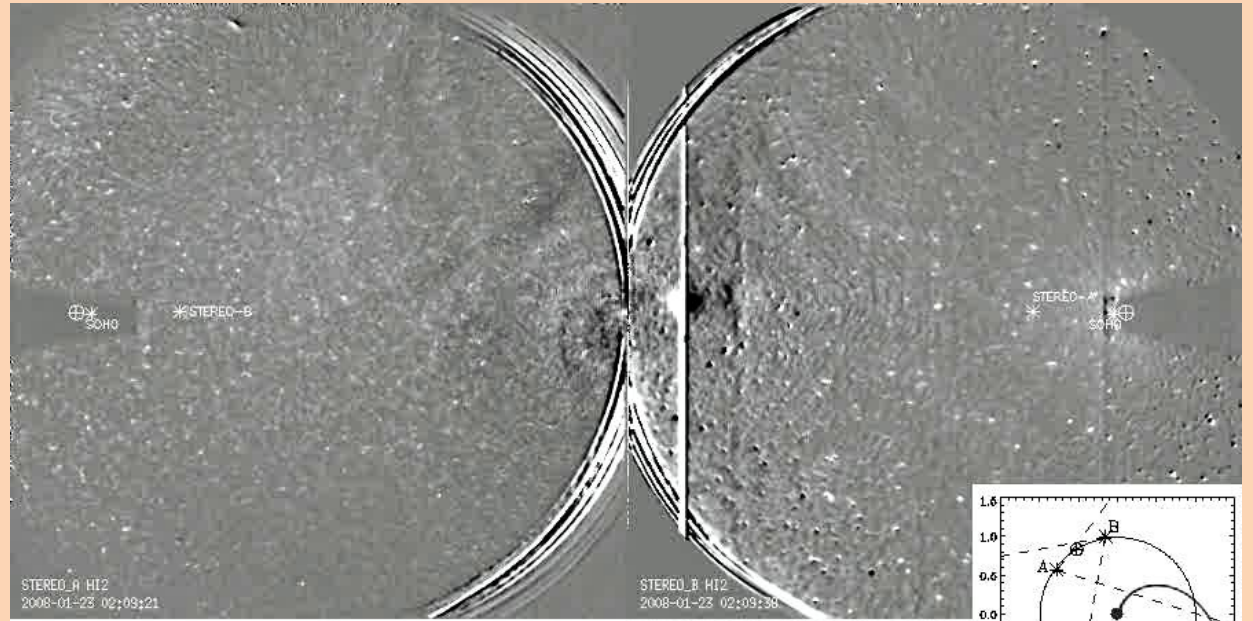


# HI2-A

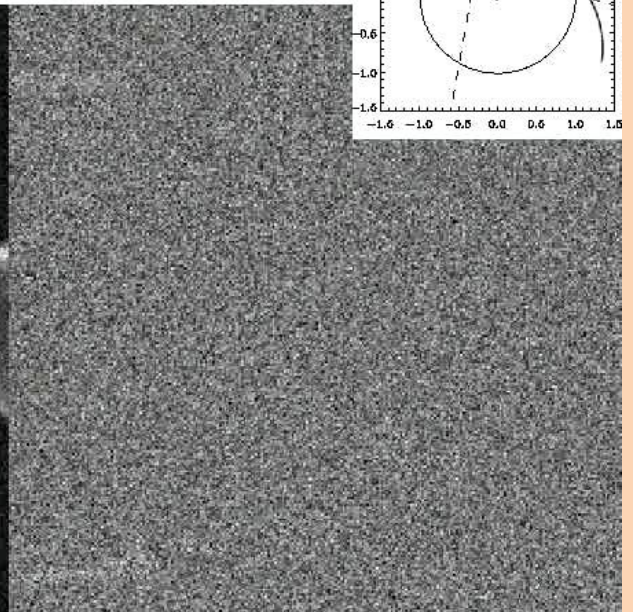
# HI2-B

## Three Dimensional Reconstructions of Corotating Interaction Regions

Brian E. Wood, Russell A. Howard,  
Dennis G. Socker

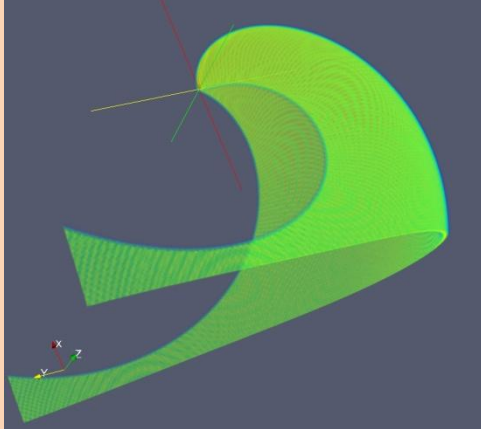


Synthetic HI2-A image

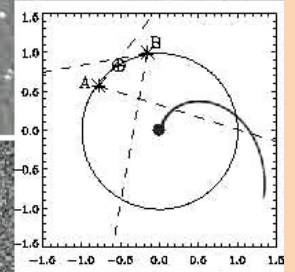


Synthetic HI2-B image

### 3D CIR model



Wood et al. 2010, ApJ, 708, L89



# Building a 3-D CIR

The following equations define the shape of a 2-D CIR shape in cylindrical coordinates in 3-D space, where  $\psi \in [0, 2\pi]$  and  $\eta \in [-1, 1]$ .

$$r = \alpha(2\pi - \psi)$$

$$\theta = \psi - 2\pi + \phi_C - \gamma\eta^2$$

$$z = \beta\eta r.$$

A 3-D density distribution is then derived by assuming a Gaussian density profile normal to the 2-D CIR shape, such that if  $\delta(r, \theta, z)$  is the distance of a point from the CIR midplane, then

$$n_e(r, \theta, z) = n_{max} \exp \left[ -\frac{1}{2} \left( \frac{\delta(r, \theta, z)}{\sigma_n} \right)^2 \right]$$

For our morphological purposes, we simply set  $n_{max}=1$ . For the 2008 January 31 CIR, our best fit has the following parameters:

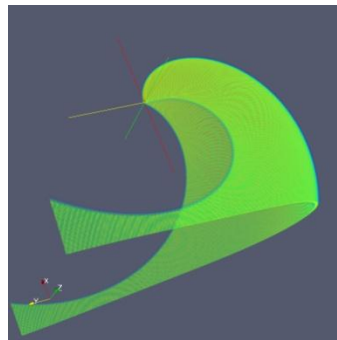
$$\alpha = 0.802 \text{ AU/rad}$$

$$\phi_C = 6.091 \text{ rad}$$

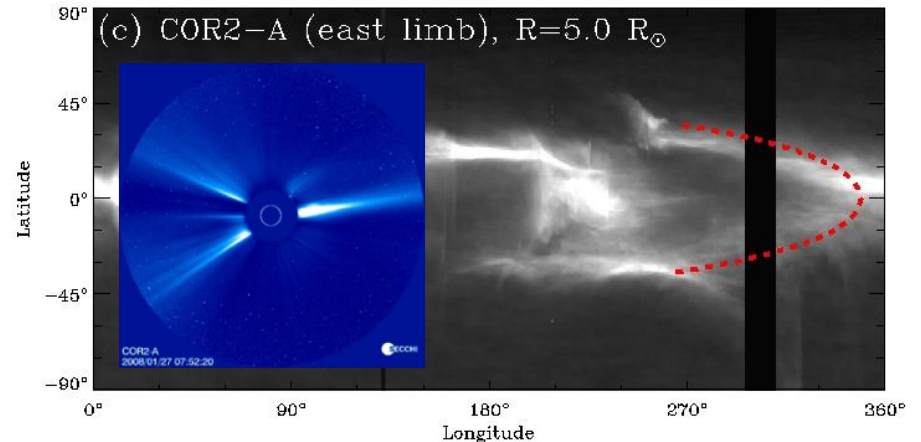
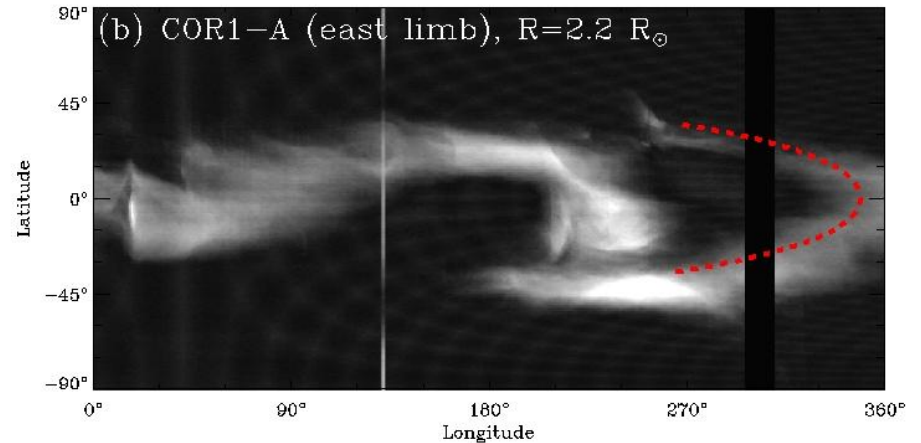
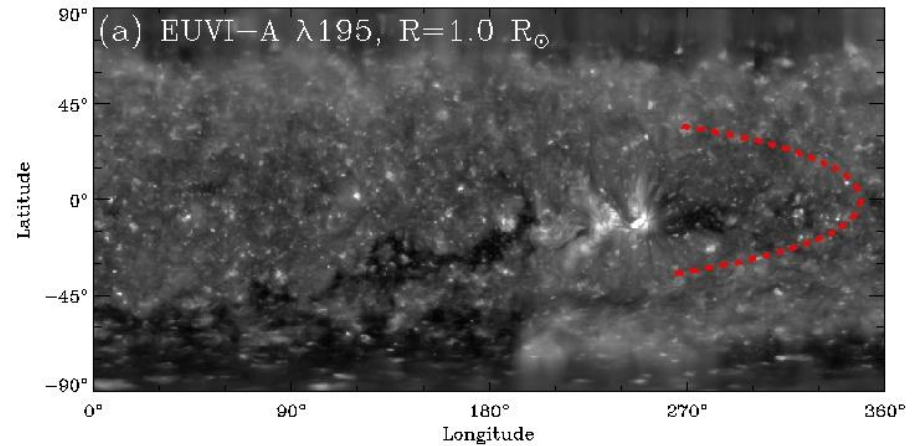
$$\beta = 0.7$$

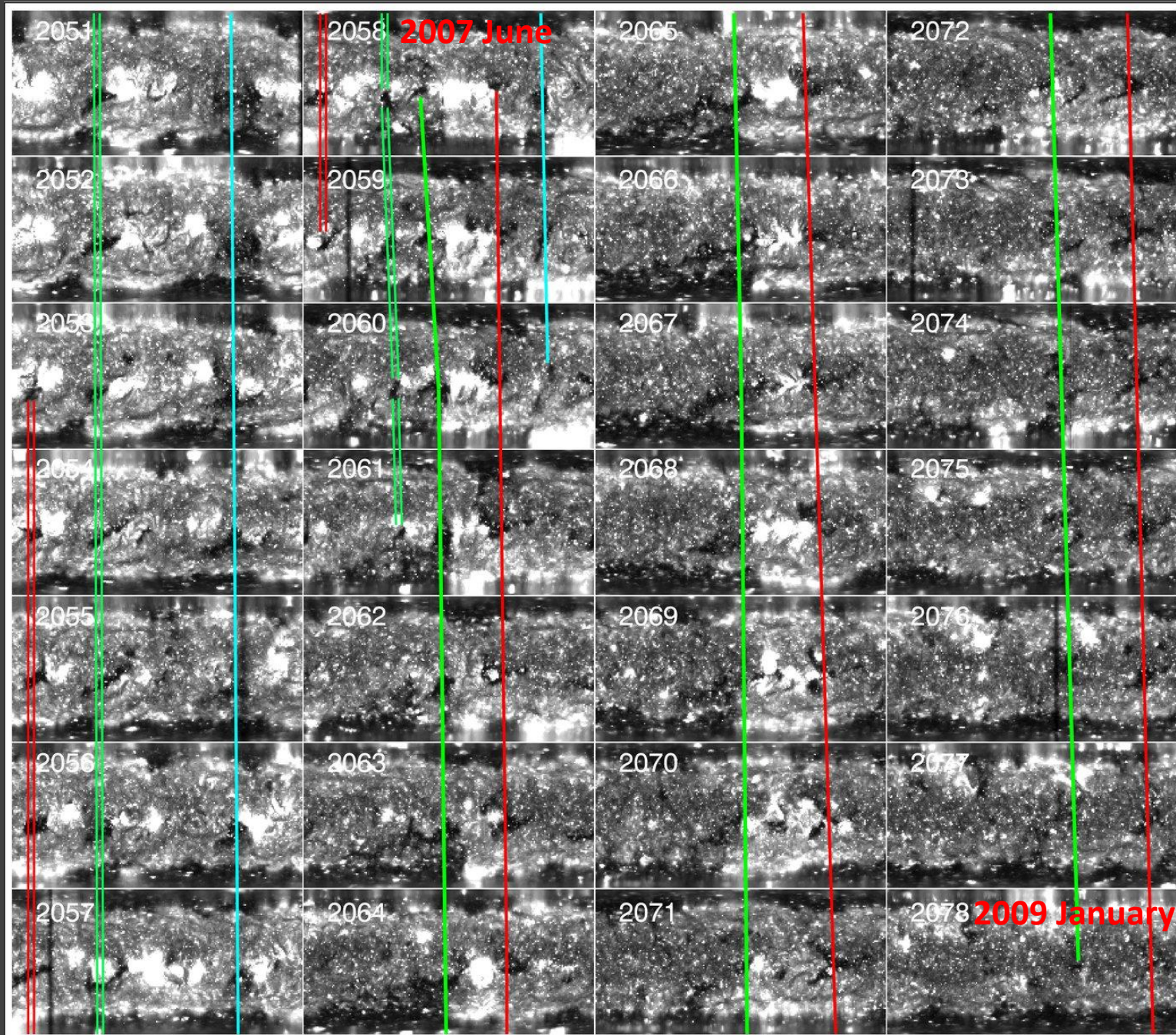
$$\gamma = 1.48 \text{ rad}$$

$$\sigma_n = 0.0098 \text{ AU}$$

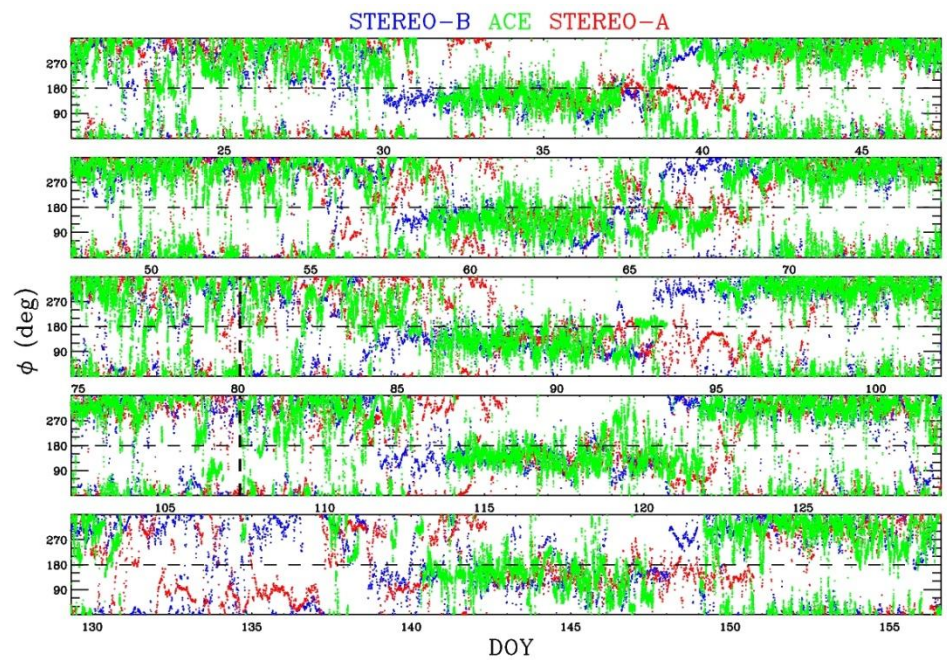
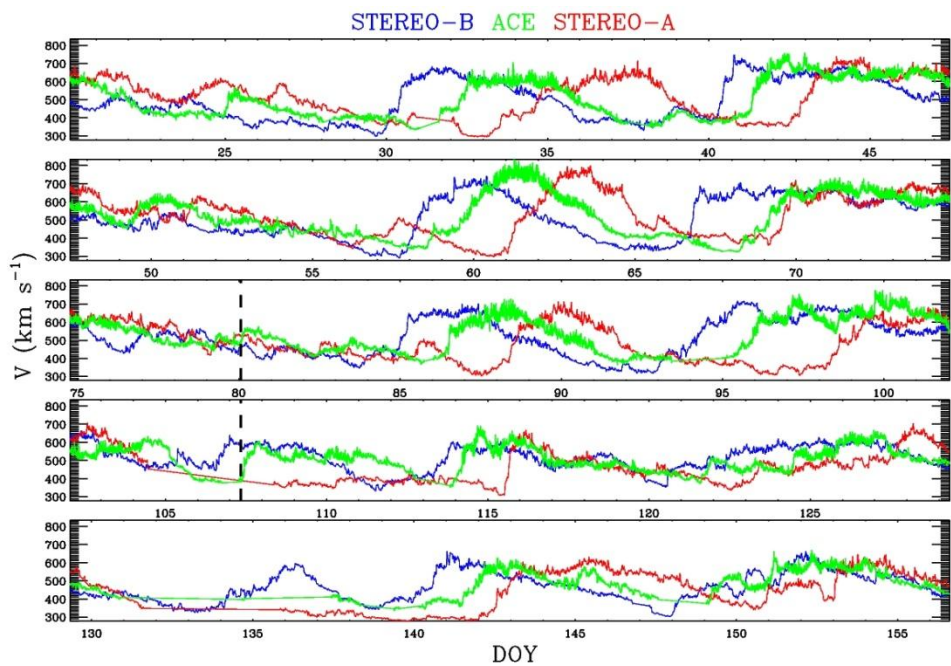
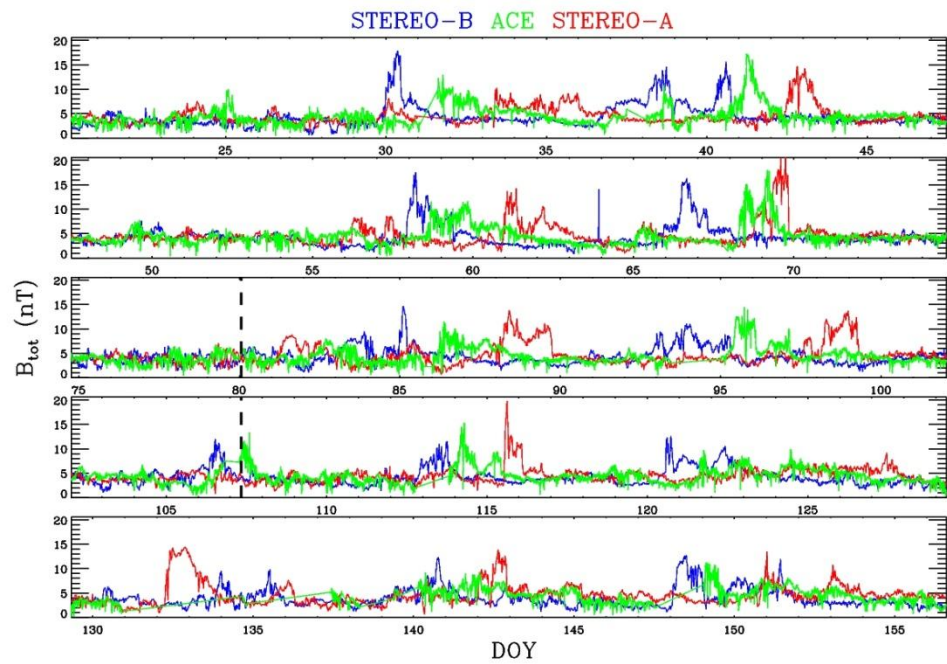
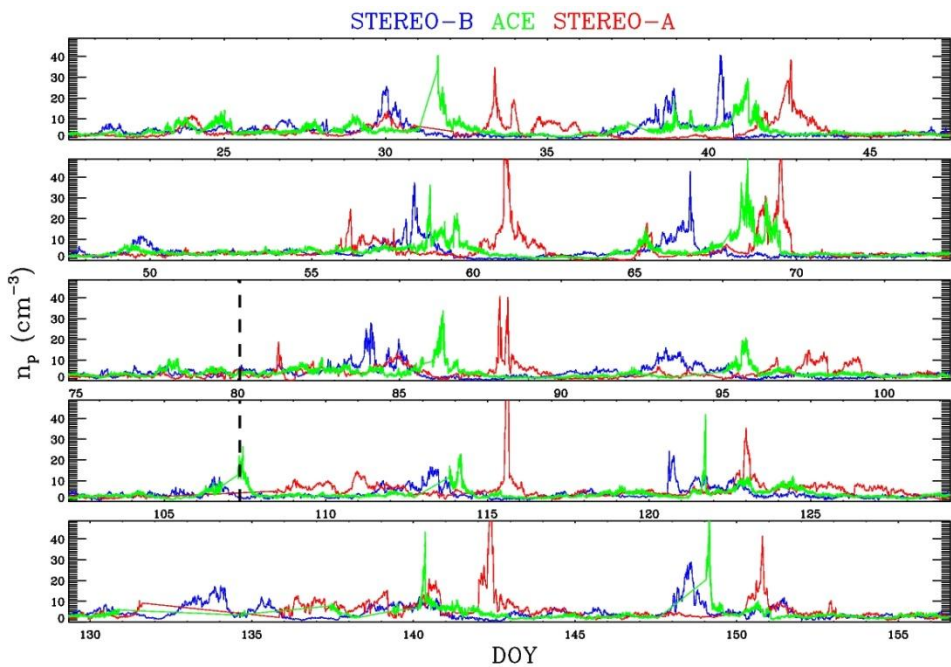


This CIR maps back to a bifurcated streamer near the Sun, which surrounds a coronal hole (see right).

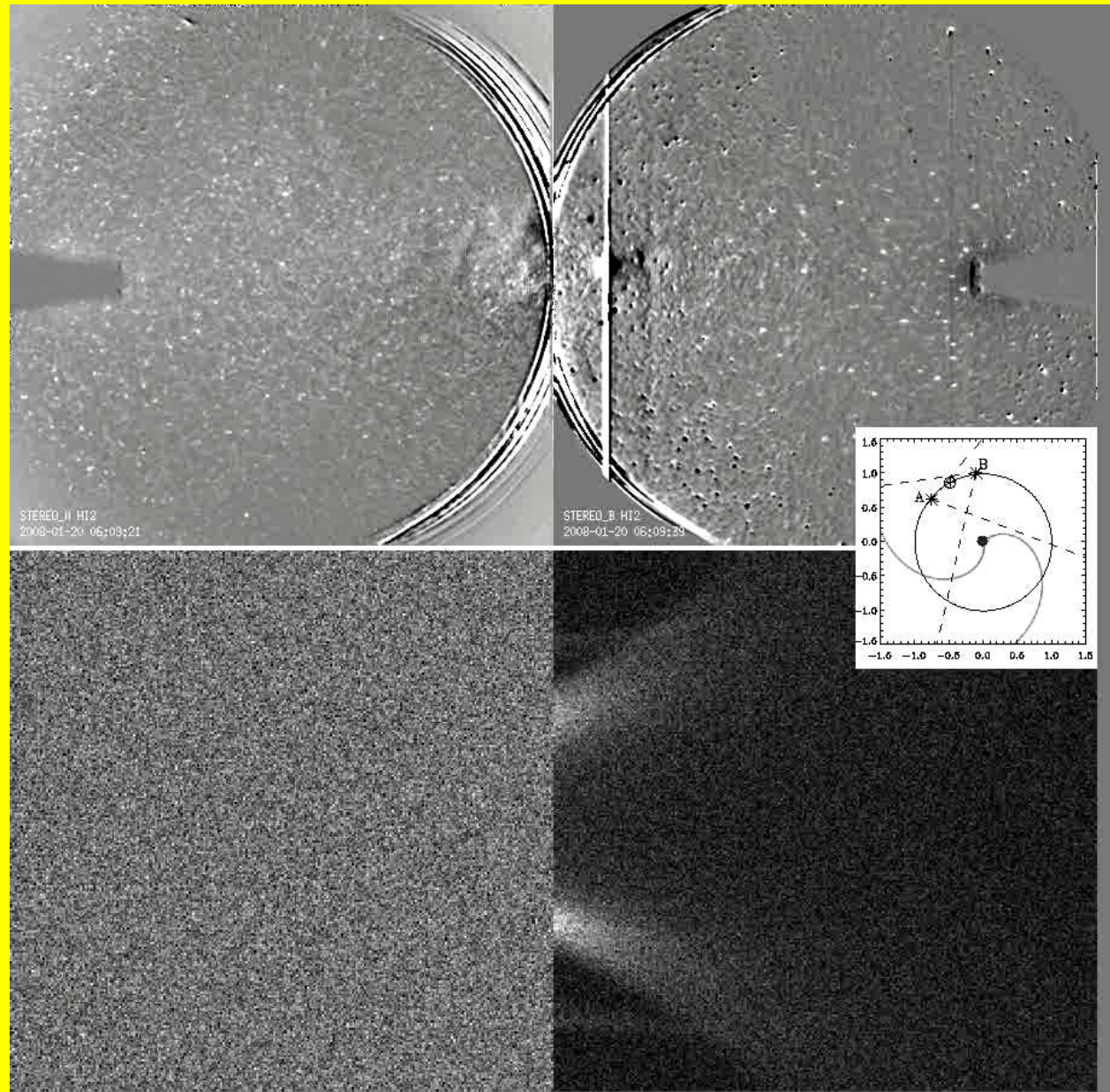
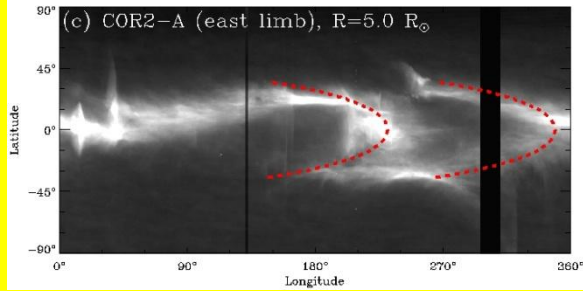
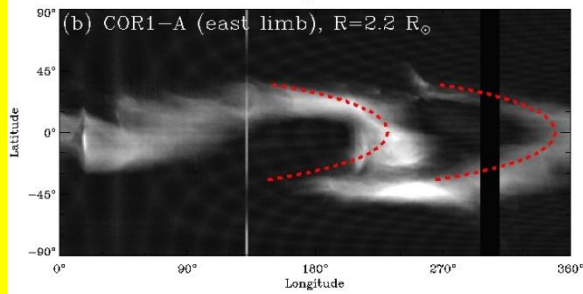
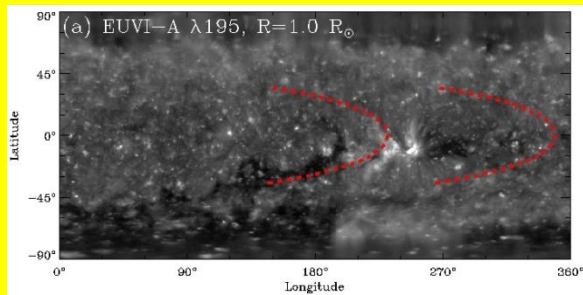




# In Situ Observations of Two CIRs in 5 Solar Rotations in 2008



# Five Rotations of Two CIRs Seen by HI2



# In Situ Observations of the 2008 Jan. 31 CIR

The curvature of the model CIR can be related to the velocity of the slow wind barrier against which fast wind is impinging by:

$$V_{eff} = 2\pi\alpha/T_C$$

This equation yields  $V_{eff}=345$  km/s, consistent with the observed velocity at the time of the CIR density pulse (see right).

The duration of the CIR density pulse (particularly at STEREO-B) can be related to the CIR model parameters via:

$$\Delta t = \frac{2.355\sigma_n}{V_{eff} \cos[\arctan(\frac{\alpha}{r})]}$$

This equation yields  $\Delta t=0.15$  days, roughly consistent with the observed density pulse (see right).

