## Some Results about Trans-equatorial Loops

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International Workshop of 2008 Solar Total Eclipse

### Outline

- Some statistical results about transequatorial loops (TLs)
- Discussion about formation of TLs



### Category

## According to the magnetic polarities that TLs connect the regions in photosphere: **PTL**, **FTL**



#### According to the numbers of TLs that the same region connected and magnetic polarities, we can classify TLs to SPTL, SFTL; MTL-PF, MPTL, MFTL





#### MTL-PF



#### **MPTL**



MFTL

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#### **Statistical results of TL**

TL (number)	356	100%
PTL	229	64%
FTL	127	36%

TL CLASSIFICATION				
STL		MTLs		
SPTL	SFTL	MTL-PF	MPTL	MFTL
120	32	70(145)	20(41)	8(18)
79%	21%	71%	20%	9%
1	52		98(204)	
43%		57%		
				6





#### **Seperation of TL**



Decreases from the minimum of solar cycle to maximum Consist with Sporer Law (Chen et al. 2006)

Comparison between the simulation results based on Babcock-Leighton dynamo model and observation by Jiang et al. 2007

Suggest the connectivities of poloidal field lines determine the TL size 9 What about the relationship of the helicity of the active regions connected by trans-equatorial loops?



**Previous study on relationship between current helicity and trans-equatorial loops** 

- Canfield et al. 1996; Farnik et al. 1999; Pevtsov 2000: helicity patterns of active regions connected by TLs tend to be same.
- Deficiency: sample is small, only using Mees data

#### Trans-equatorial loops connecting both solar hemispheres



#### Helicity patterns of active regions (43 pairs) related with trans-equatorial loops



# Helicity patterns of magnetic polarity regions (50 pairs) related with trans-equatorial loops



# Hemispheric helicity patterns of the active regions related with trans-equatorial loops



#### **Twist of trans-equatorial structures**

Rust and Kumar,

DISTRIBUTION OF SIGMOID X-RAY BRIGHTENINGS BY HEMISPHERE

Hemisphere	Forward-S	Reverse-S	Total
Northern	4	24	28
Southern	40	12	52
Cross-equator	12	11	23
Total	56	47	103



<b>Relation between TLs twist and helicity of</b>			
footpoints			

Proxy	α <sub>best</sub>		
Helicity relation of footpoints	Same		
Relation between TLs	Same	Opposite	Potential (TL)
Twist and helicity of footpoints	12	4	3

### **Formation of TLs**

#### **Magnetic Reconnection induces the formation of TLs**





**Tsuneta (1996)** 

Farnik et al. (1999)

# Magnetic reconnection happening in new emerging active region induces the formation of TLs



### **Summary**

- Transequatorial Loops (TLs) tend to connect the preceding magnetic polarities.
- The separation of TL varies following solar cycle.
- The helicity patterns of footpoints of TLs have not clear regularity, but the twist of TLs tends to be the same as their footpoints.
- The new emerging active region can induce the formation of TLs.