“Magnets in Space”

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Magnetic Field Lines
Our Sun
Magnetic Fields Dancing on the Sun

http://vestige.lmsal.com/TRACE/

Images from NASA’s “TRACE” Satellite
Earthlings Saved by Magnetic Fields!*

*but not the poor (surface) Martians, or Venusians!
Earthlings Saved by Magnetic Fields!*  

Aurora Borealis
A Star-Forming Region
The Old( er) 
The Young & the Unborn

NGC 3603
PRC99-20 • STScI OPO • June 1, 1999
Wolfgang Brandner (JPL/IPAC), Eva K. Grebel (Univ. Washington), You-Hua Chu (Univ. Illinois, Urbana-Champaign) and NASA
Star and Planet Formation

Molecular or Dark Clouds

"Cores" and Outflows

Solar System Formation

1 pc = 3 lyr

Jets and Disks
Jets from Young Stars

PRC95-24a · ST Sc1 OPO · June 6, 1995
C. Burrows (ST Sc1), J. Hester (AZ State U.), J. Morse (ST Sc1), NASA
What magnetic fields have to do with this whole picture?
Magnetic Fields in Star Forming Gas

Stone, Gammie & Ostriker 1999

\[ \beta = \frac{[T/10 \text{ K}]}{[n_{H_2}/100 \text{ cm}^{-3}][B/1.4 \mu \text{G}]} \]

- Driven Turbulence; \( M \to K \); no gravity
- Colors: log density
- Computational volume: \( 256^3 \)
- Dark blue lines: B-field
- Red: isosurface of passive contaminant after saturation
Star Formation the Easy Way (that doesn’t work)

Fragments Collapse Under Gravity into "Protostars"  
\[ \text{time} \approx 10^5 \text{ years} \]

Global Instability (e.g. Jeans)
Fragments Cloud (hierarchically)  
\[ \text{time} \approx 10^6 \text{ years} \]

Hoyle 1953
Ta-Da

A Group of Young “Zero-Age Main Sequence” Stars is Born
The (Beautiful) Ugly Truth

Gaseous Pillars • M16

PRC95-44a • ST ScI OPO • November 2, 1995
J. Hester and P. Scowen (AZ State Univ.), NASA

HST • WFPC2
The Orion Nebula

Hubble Space Telescope
Wide Field Planetary Camera 2