



Chandra
X-Ray Observatory

Star Formation in the Era of Three Great Observatories:

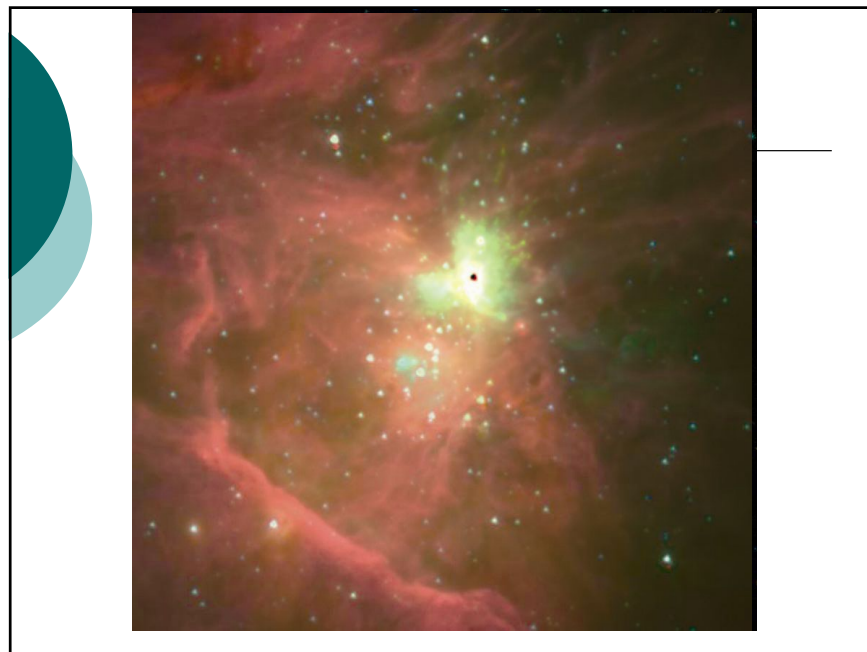
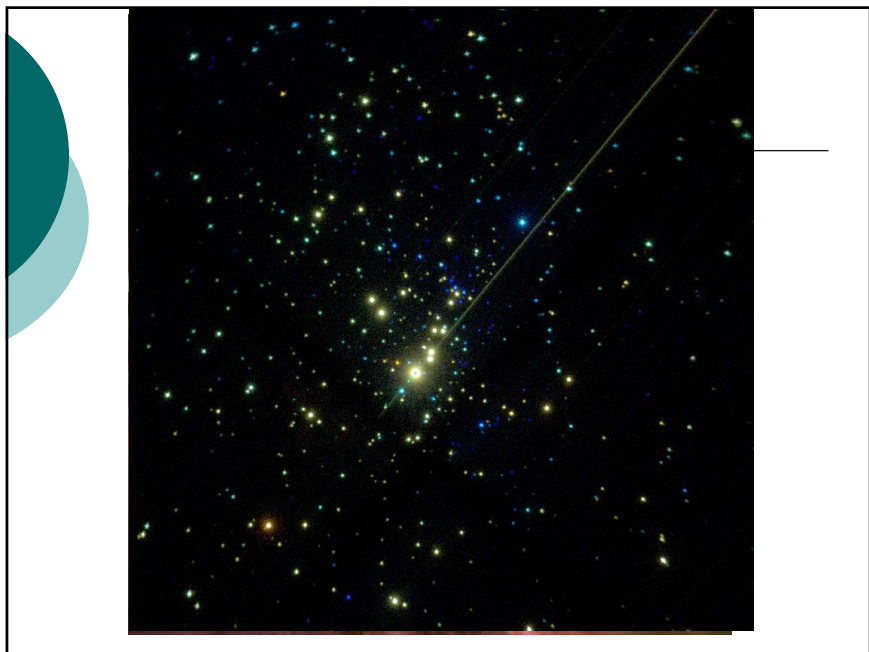
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Capabilities

- **Spitzer** - *Traces the evolution of circumstellar dust and dust envelopes.*
- **Hubble** - *Traces the evolution of the ionized gas. In its first 15 years HST has changed how we view almost all aspects of the latter phase of star formation.*
- **Chandra** - *Traces the evolution of the (proto)stellar magnetic field.*

Orion as a Case Study





Lessons learned from Orion

- Program cannot be done as a joint program.
 - Survived triple jeopardy.
 - Three separate groups (for good or ill)

Key Questions

- **Questions about populations.**
 - How does one obtain a "complete" census of a cluster?
 - What is the general sequence of events by which a star goes from having a full optically thick disk to being "naked"?
 - Are brown dwarfs formed independently, via ejection or both?
- **Questions about Disks**
 - What is the feedback between ionization and disk accretion?
 - What produces the inner disk clearing in transitional disks?
 - Does the inner disk fill again? Are there repeated episodes of disk clearing?
- **Questions about diffuse X-ray emission and dust structure**
 - Where do the SNe that produce the X-ray superbubbles come from?
 - Why are massive clusters sitting at the edges of dense clouds?
 - Why do most massive star-forming GMCs look so similar?
 - What is the sub-structure and content of extragalactic IR super star clusters?

More questions

- Is the IMF Universal?
- Astrophysics
 - Disks, Jets, winds
- Can we understand massive SF in our galaxy to better understand other galaxies?
- How do massive stars form?
 - Figer poll
 - First stars
 - Star formation in other Galaxies
 - Starbursts, galactic nuclei, etc.
 - Natal Molecular clouds.
 - Formation, evolution changes in dust properties.
 - B fields
 - Physics of Star formation,
 - Mergers, tracers..what traces what,
 - Triggered star formation
- Impact of star formation on the ISM (feedback)

Some Crucial observations

- **Spitzer**
 - IRAC and MIPS photometry needed to classify low-mass YSOs.
 - Provide catalogs of embedded protostellar objects just emerging from the envelope infall phase to fully revealed star/disk systems
- **Chandra**
 - Deeper *Chandra* observations are needed to identify cluster populations. Future X-ray observatories will not resolve distant, young galactic cluster stars. At 2 kpc and $AV \sim 4$, a 600 ks ACIS-I exposure is needed to achieve a 2-8 keV $\log L_x \sim 28.8$ for a cluster of about 1Myr, thereby detecting half of all stellar cluster members.
 - Map the Spitzer C2D, FEPS and Glimpse legacy fields in X-rays.
 - There is additional interest in the role of instabilities and/or turbulence in stabilizing planetary orbits.
- **XMM-Newton**
 - Survey of hard coronal component in nearby regions of star formation.
 - Additional spectroscopic studies of young stars to better understand the role of accretion in X-ray production.
- **Optical/HST**
 - Carry out pathfinder imaging and spectroscopic observations of proto-stellar envelope morphology and kinematics

Critical Observations

- Hubble
 - What are the critical targets?
 - Superclusters (W1,NGC 644 done)
 - Where are UV observations especially critical?
 - Ultra metal weak stars
 - First EPOCH ACS astrometry for cluster dynamics.
- Spitzer
 - IRS targets.
 - Deeper maps of some IRAC/MIPS fields?
- Chandra
 - Matching the Spitzer catalog in breadth
 - LMC mapping to match Spitzer?

Ideas

- COUP II
 - Flanking Fields
 - Eta Carina
 - NGC 281
 - 30 Dor – nearest starburst
- X-ray map the Orion A cloud
- X-ray map the remainder of the Porras sample
 - Make the Spitzer maps deeper
- An IRS atlas of every type of star.
 - Samples from all locations on the HR diagram varies activity levels etc.. Etc.
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BS (big science) Working Group

- Invite more people in.
- Solicit list of key questions.
- Solicit list of ideas.
- What answers are going away ..time ordered list.
- Request abstracts from those who submit ideas.
 - What questions does it address
- Vote! (first second and third)
 - What do you think is a good idea?
 - What do you want to work on?
- Develop the top 5-7 as bullet points
- Vote again
- Flesh out the top 3 so they can be presented as 15 minute talks at CS 14.
- Meet at CS 14 and fill in the remaining details.