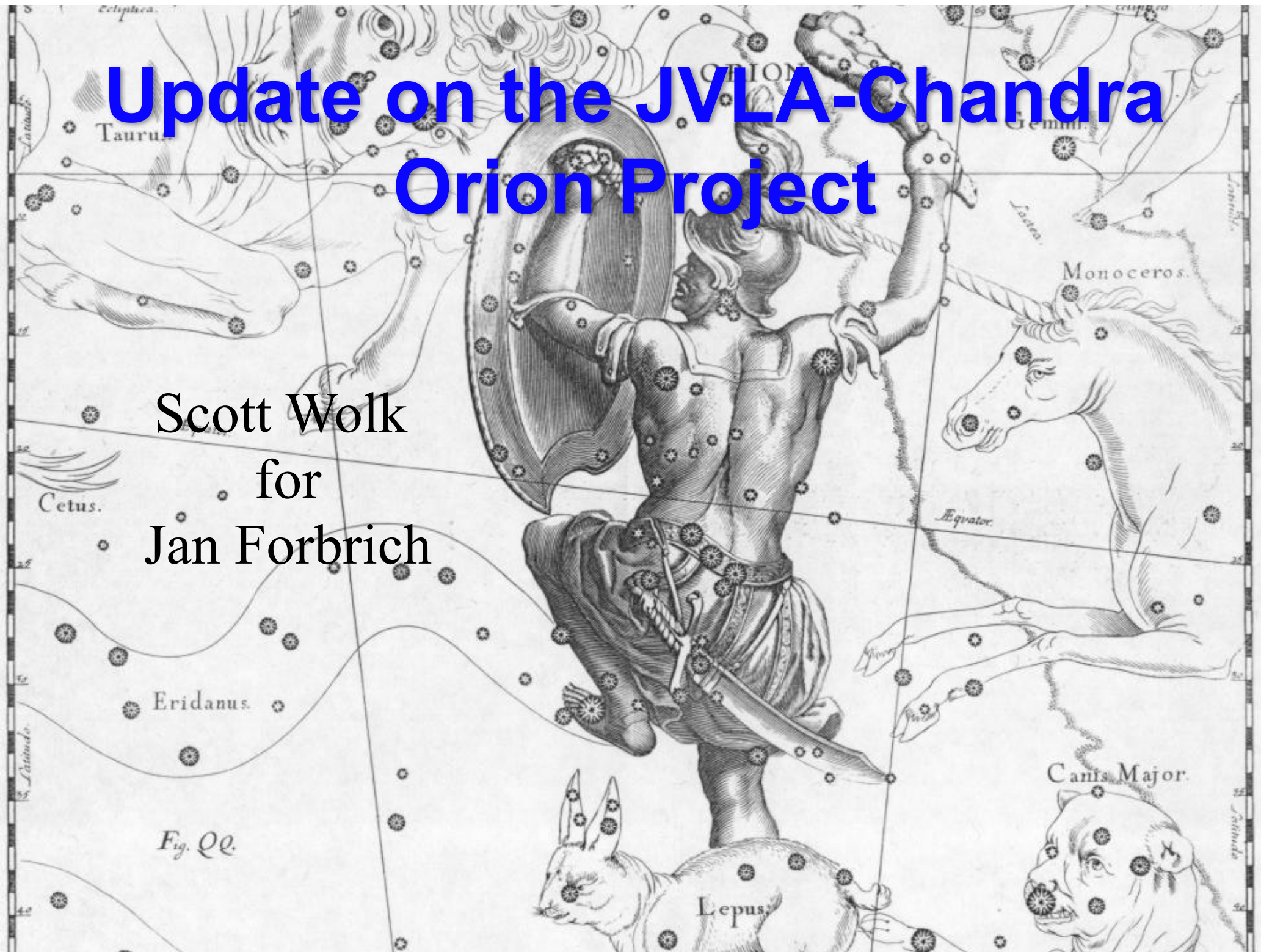
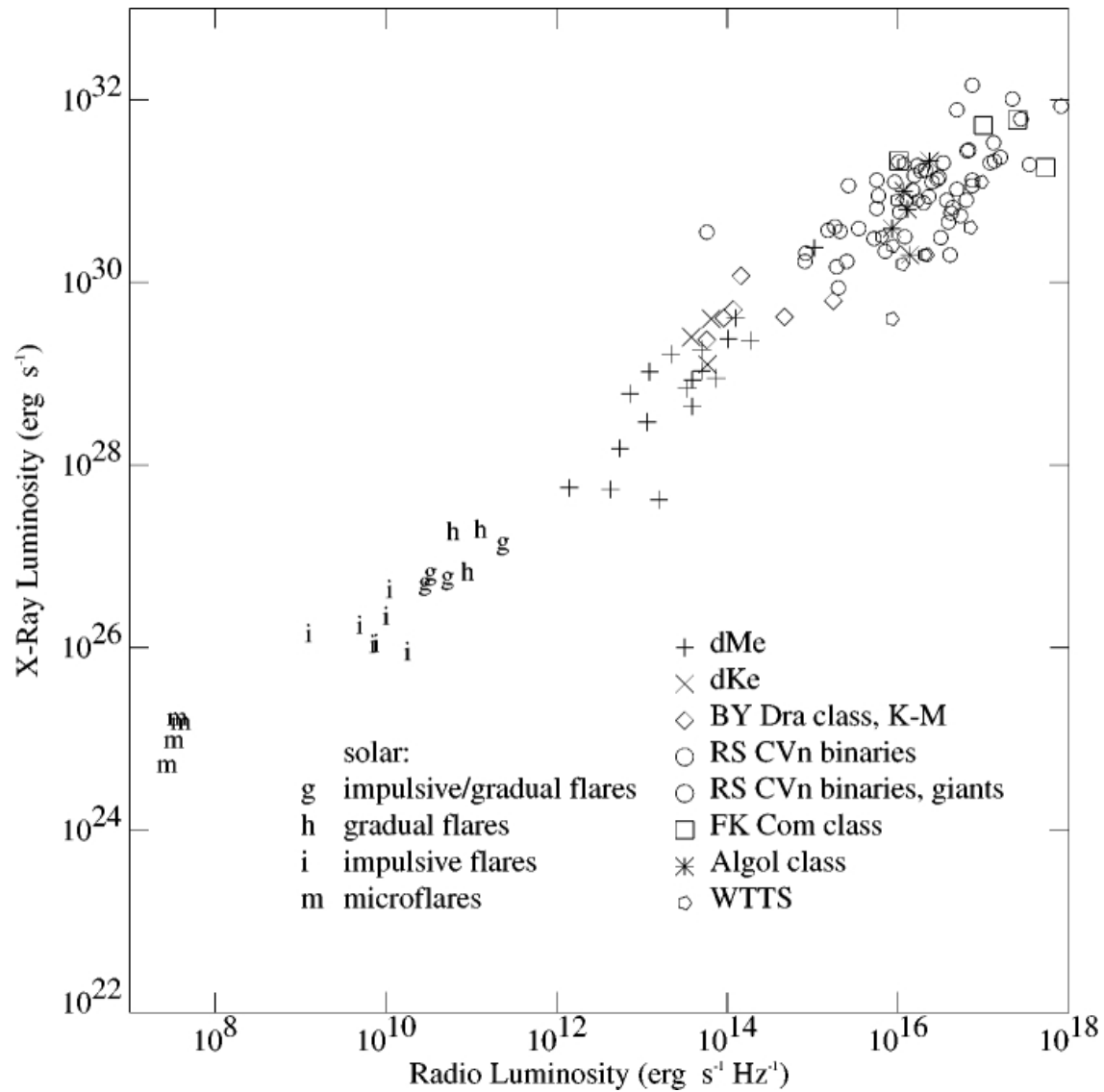


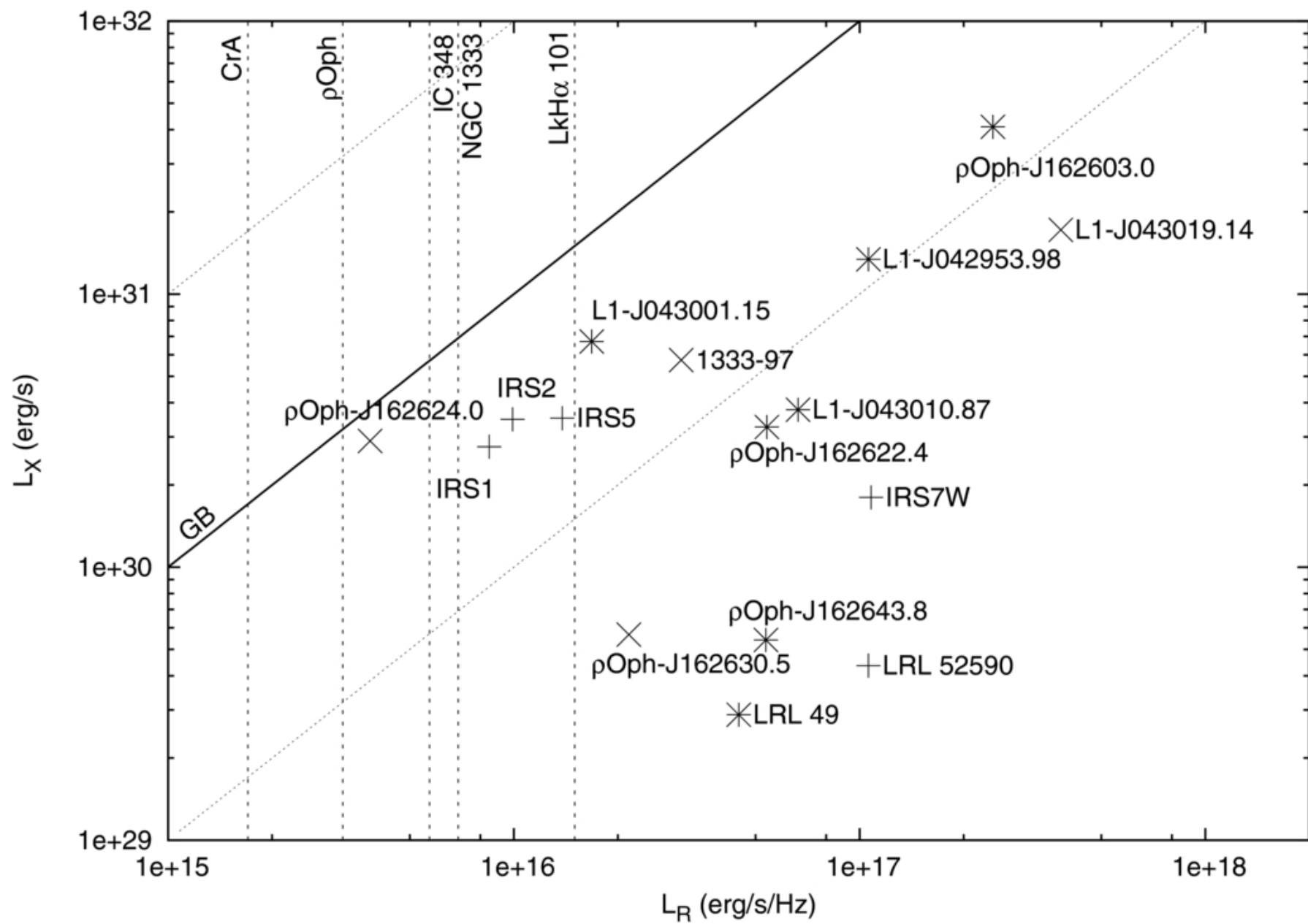
Update on the JVLA-Chandra Orion Project

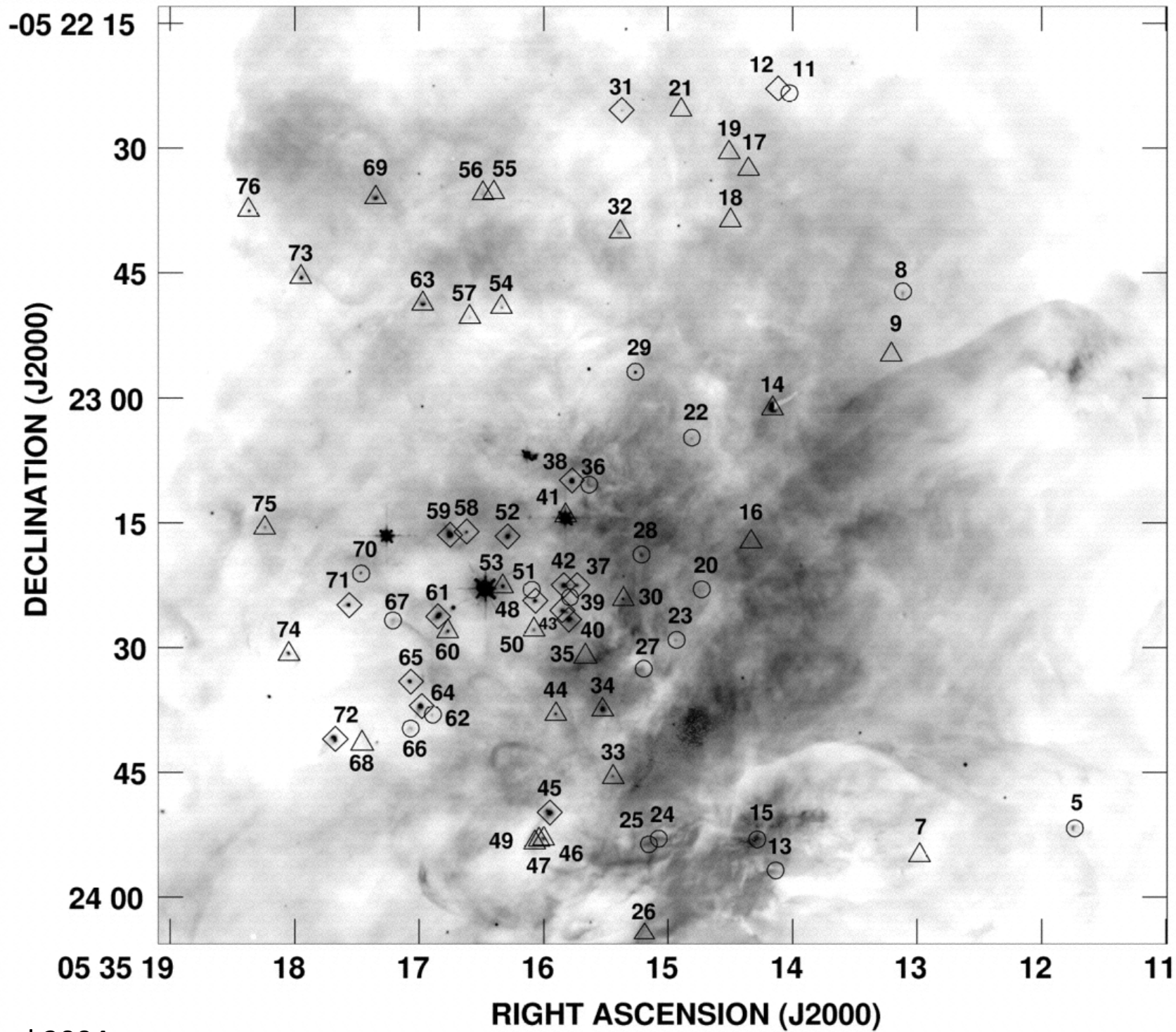
Scott Wolk
for
Jan Forbrich

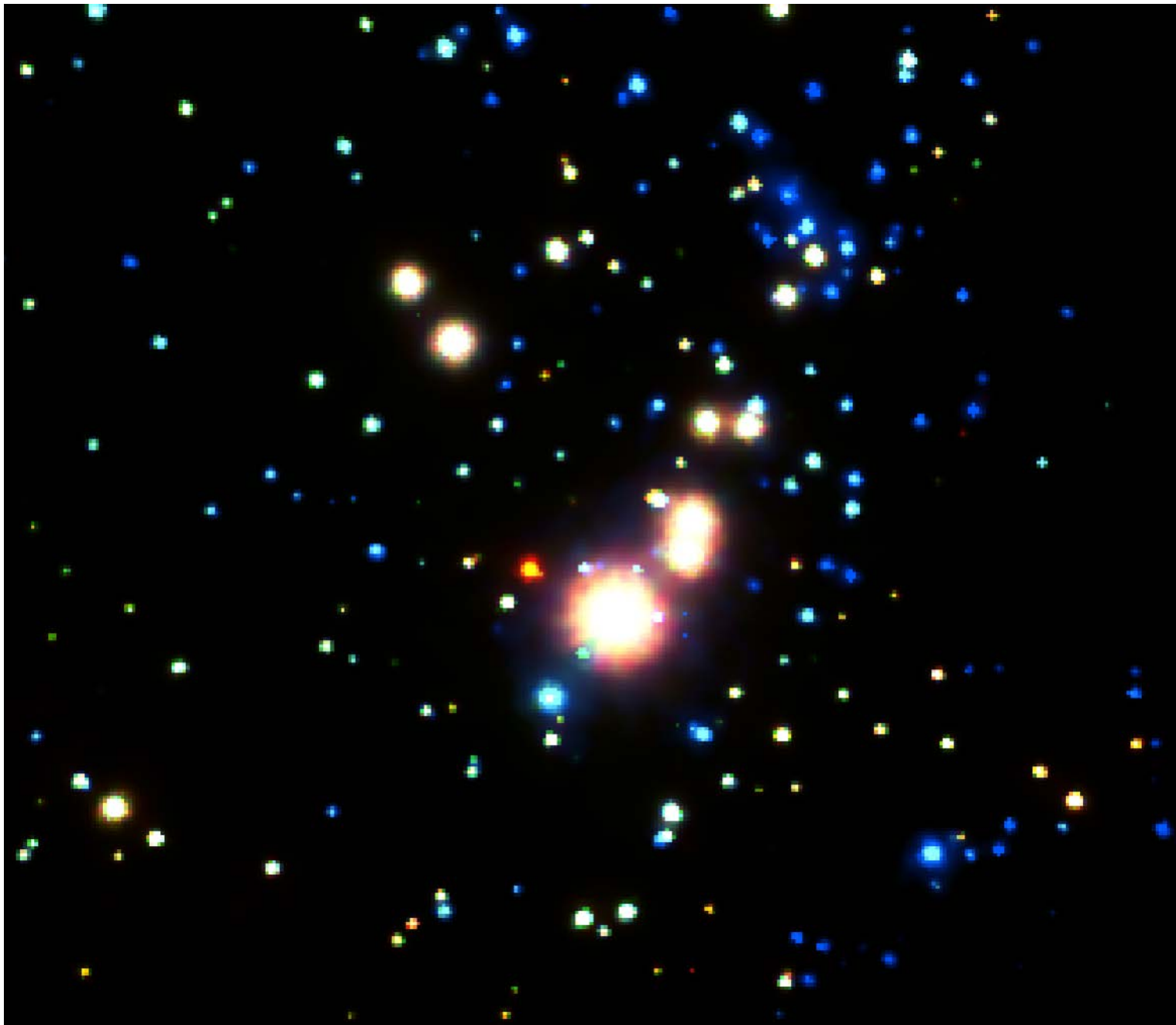


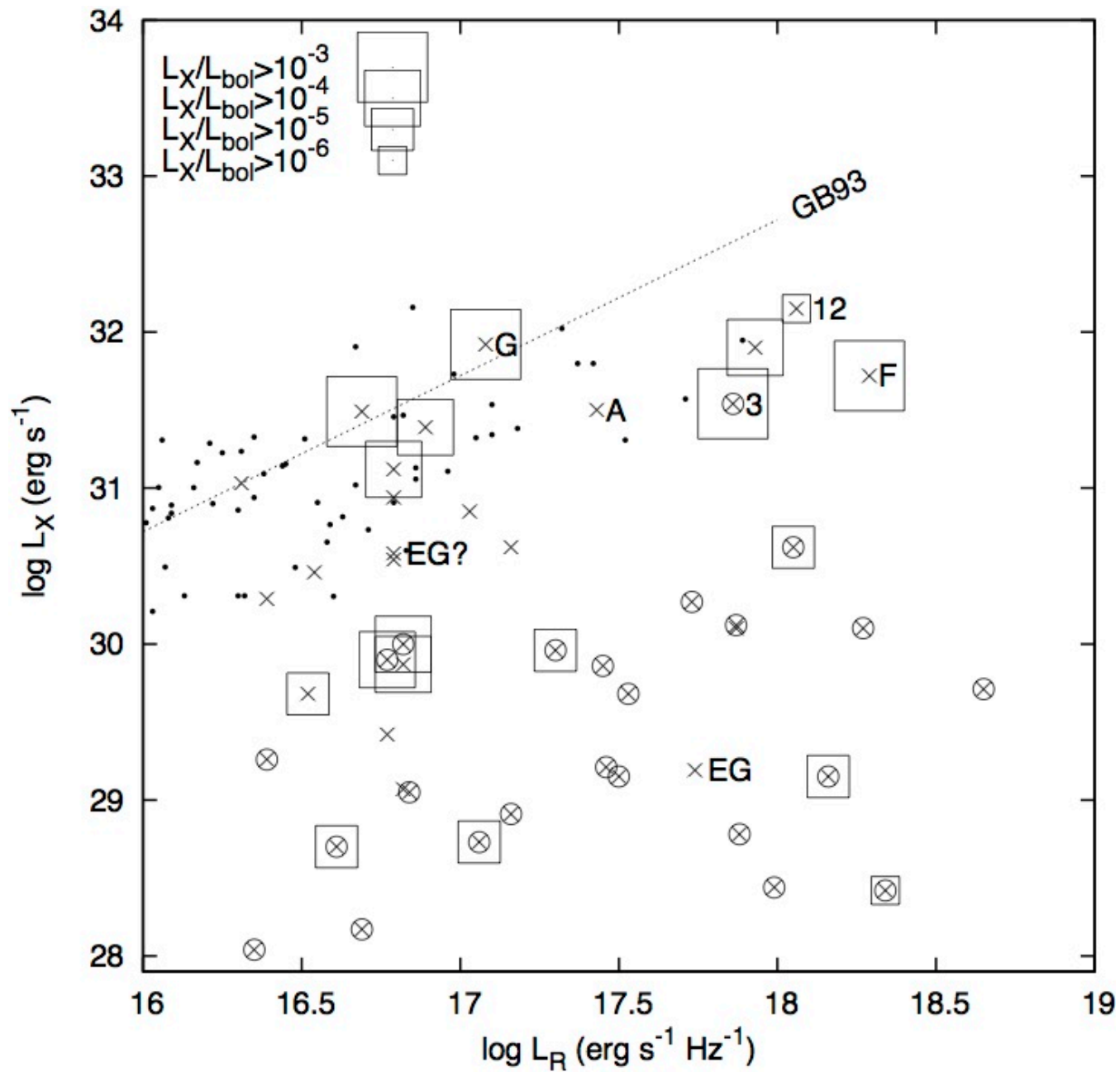
The radio-X-ray connection



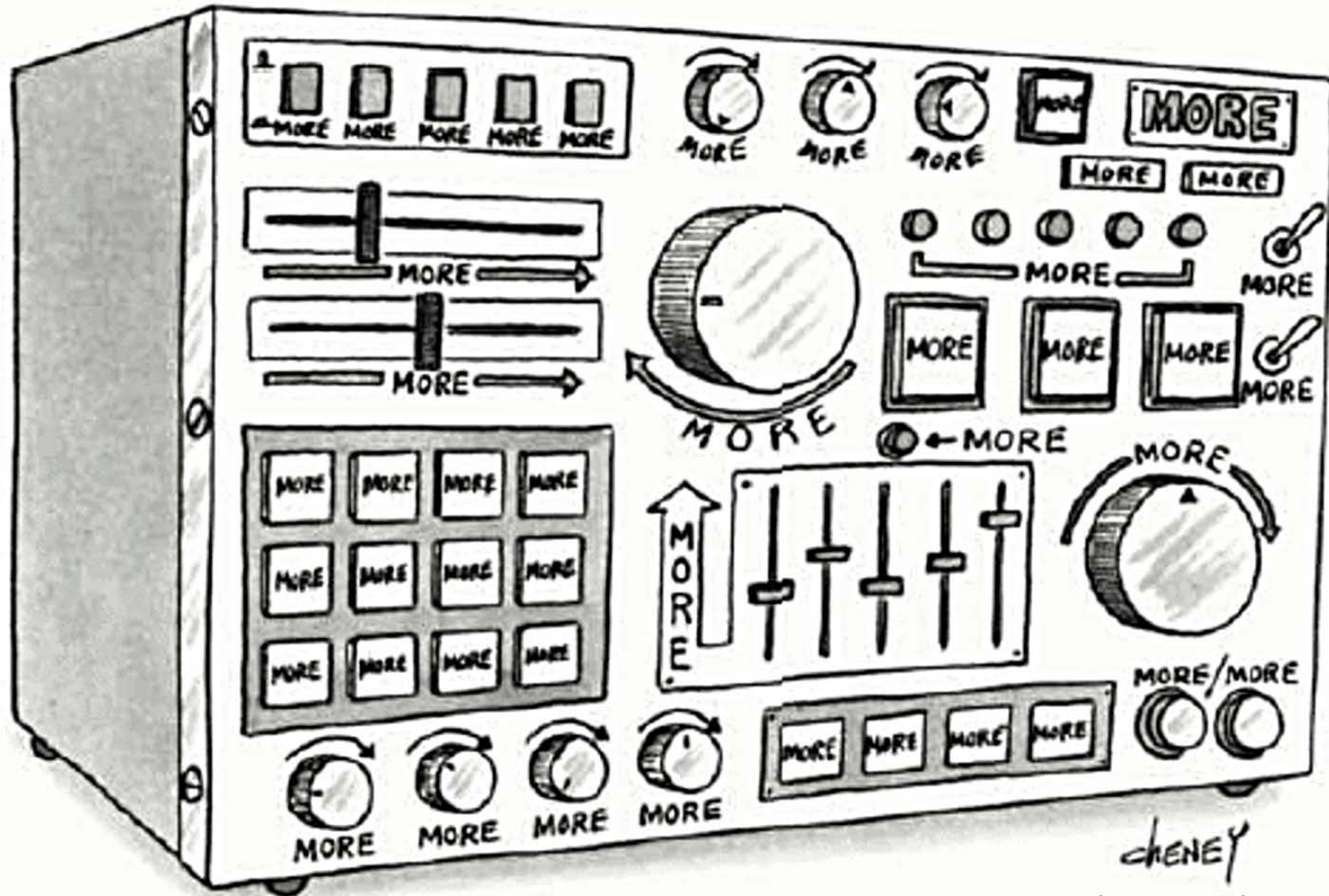








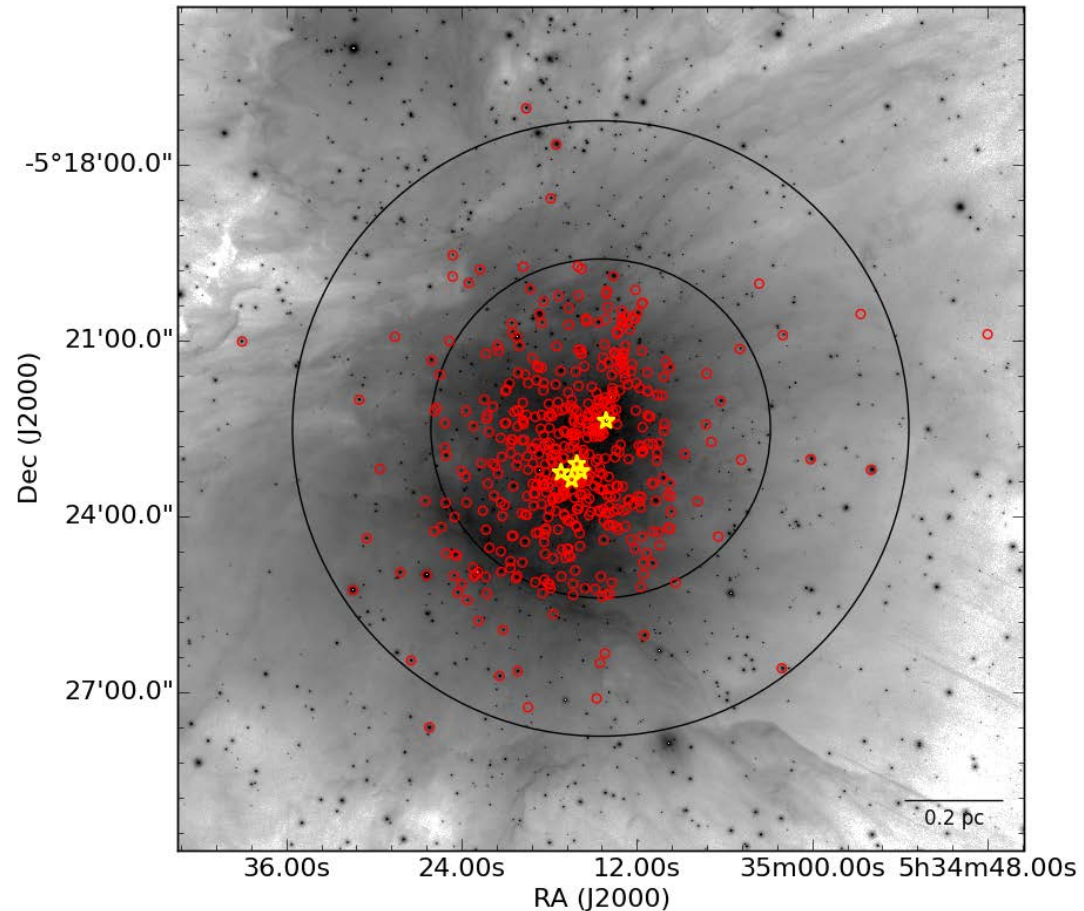
The essence of the VLA (and VLBA) upgrade



The New Yorker

The Orion Radio All-Stars: a new deep centimeter radio look at the Orion Nebula Cluster

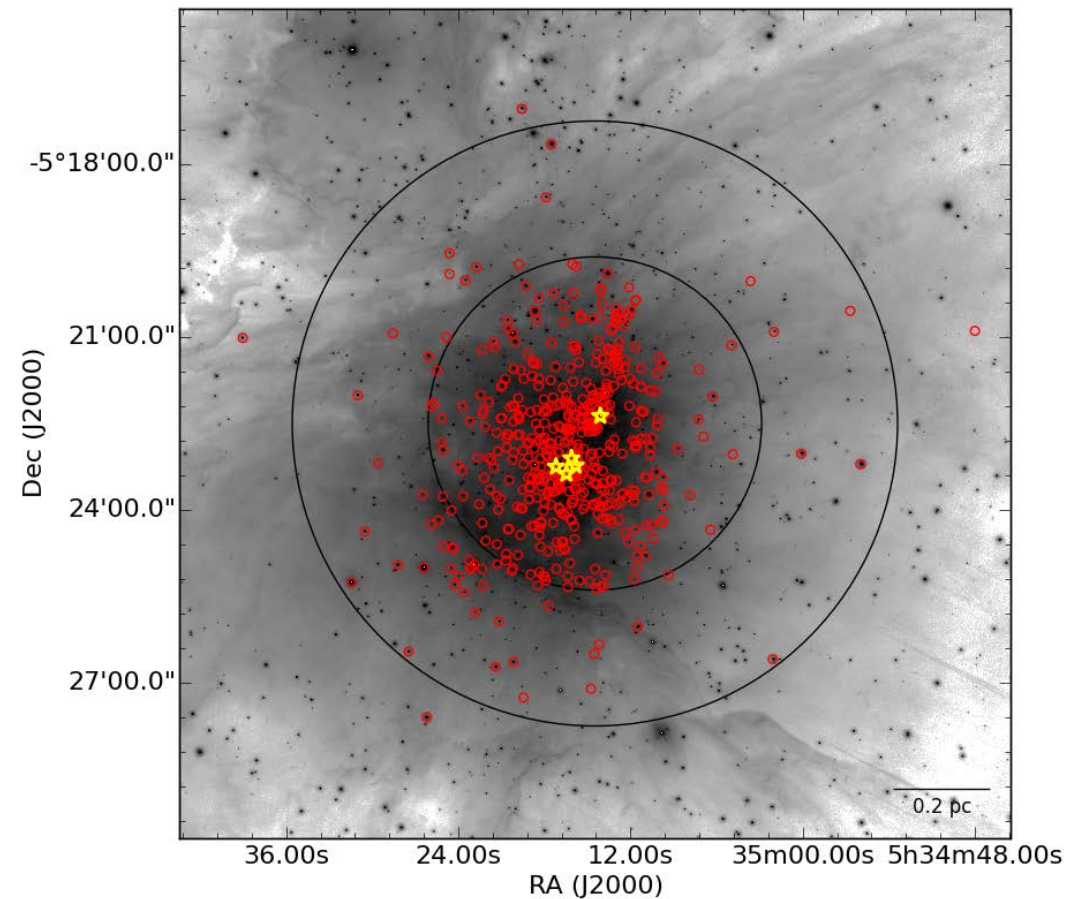
- 30h of VLA C-band data in a single pointing toward the ONC, in the A configuration, with simultaneous Chandra observations. Increased the number of known radio sources by 7x. First systematic time domain data set for YSOs.
- 30h of VLA C-band observations in surrounding fields, with simultaneous Chandra and NuSTAR observations.
- 4+ epochs of astrometric VLBA follow-up of all 556 VLA sources



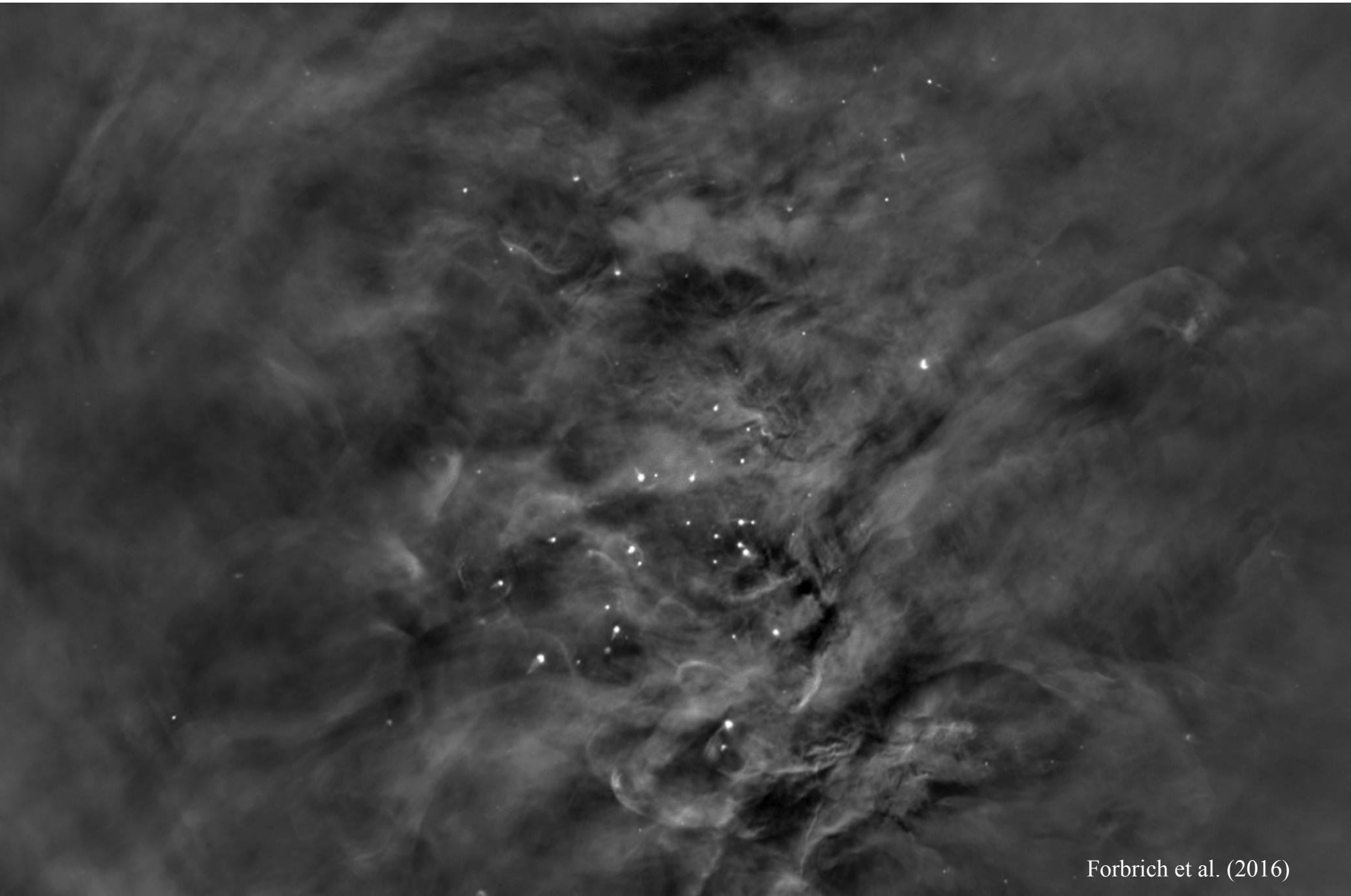
Forbrich et al. (2016)

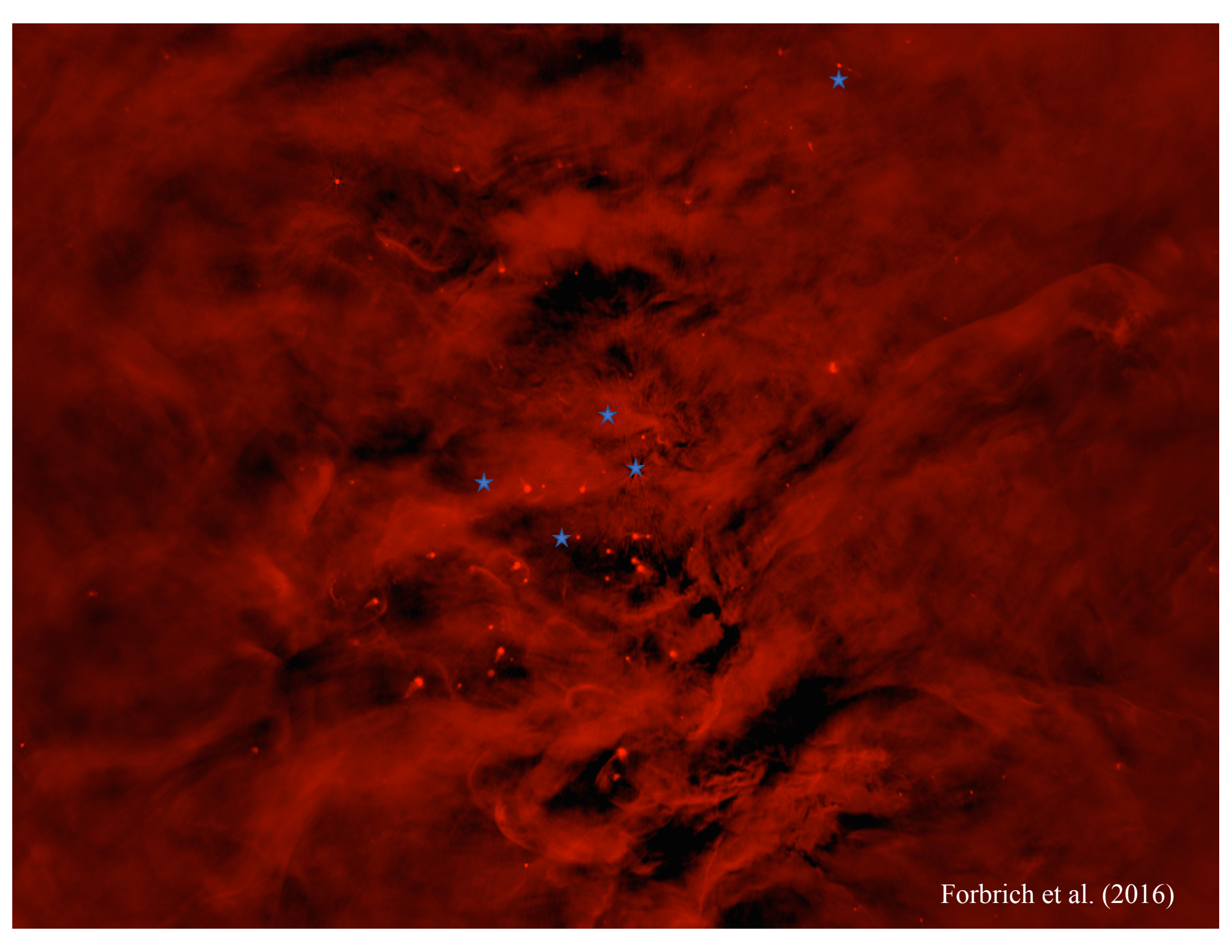
The Orion Radio All-Stars: a new deep centimeter radio look at the Orion Nebula Cluster

- **New technical challenges** in interferometric imaging
- Wideband receivers and their vastly increased continuum sensitivity, combined with in-band spectral indices, come at the price of a much more complex primary beam to be accounted for.
- Entering the time domain is tricky when your main imaging algorithms (like CLEAN) assume a constant sky. Not accounting for variability has an impact on imaging dynamic range, both in VLA and ALMA data.
- In both areas, new algorithms are in development, but they are (of course...) compute-intensive.



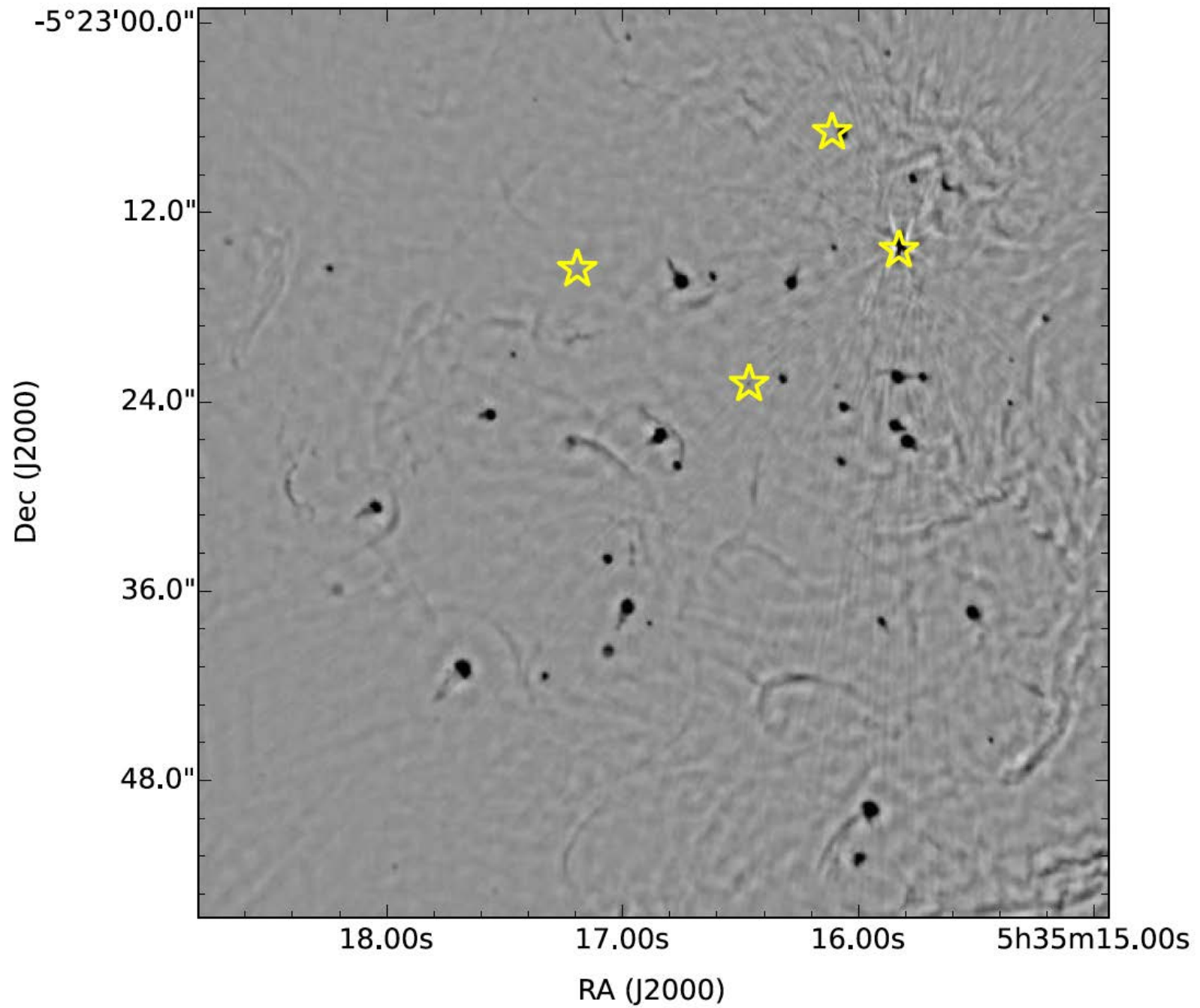
Forbrich et al. (2016)



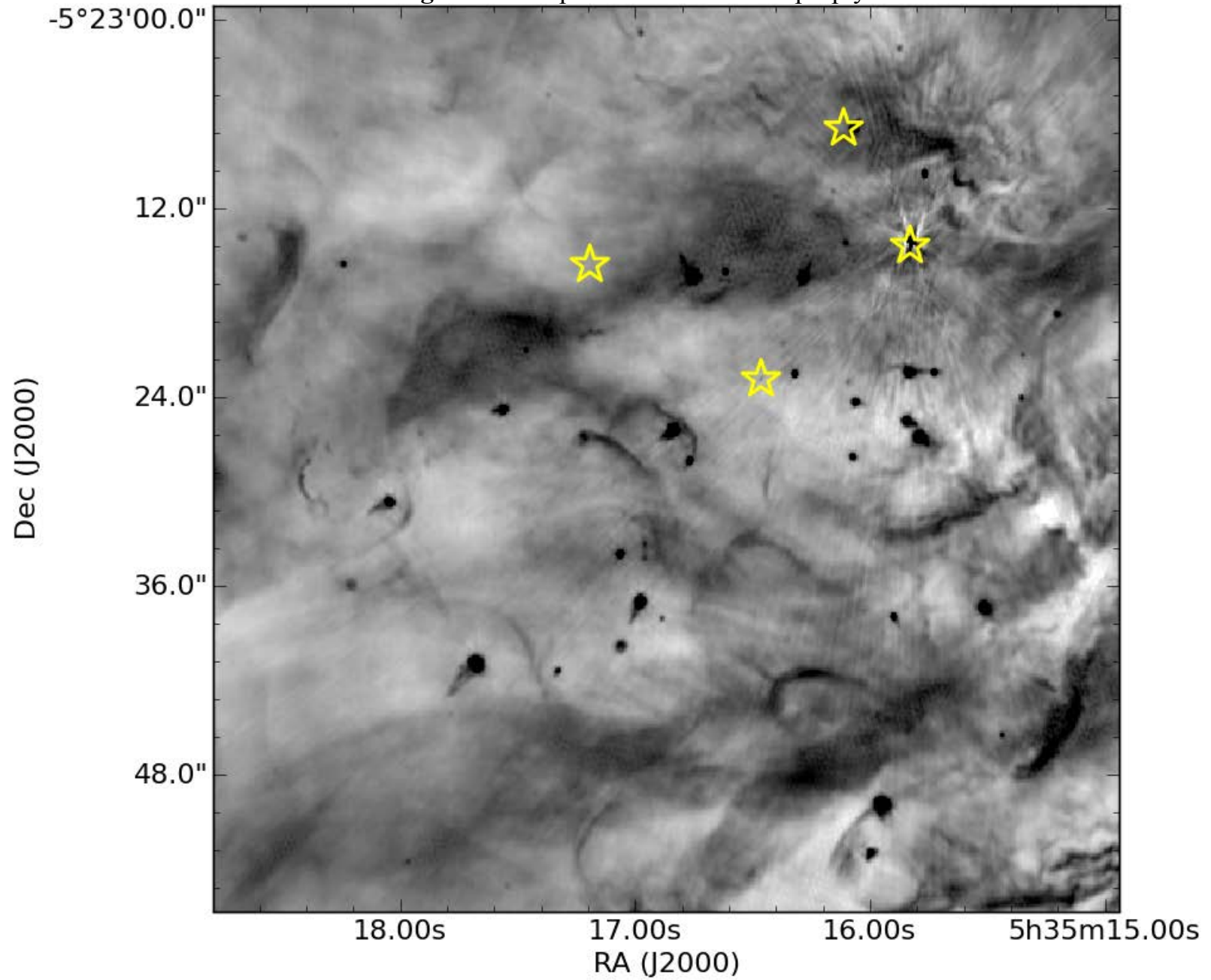


Forbrich et al. (2016)

with and additional spatial filtering ($100\text{ k}\lambda$).

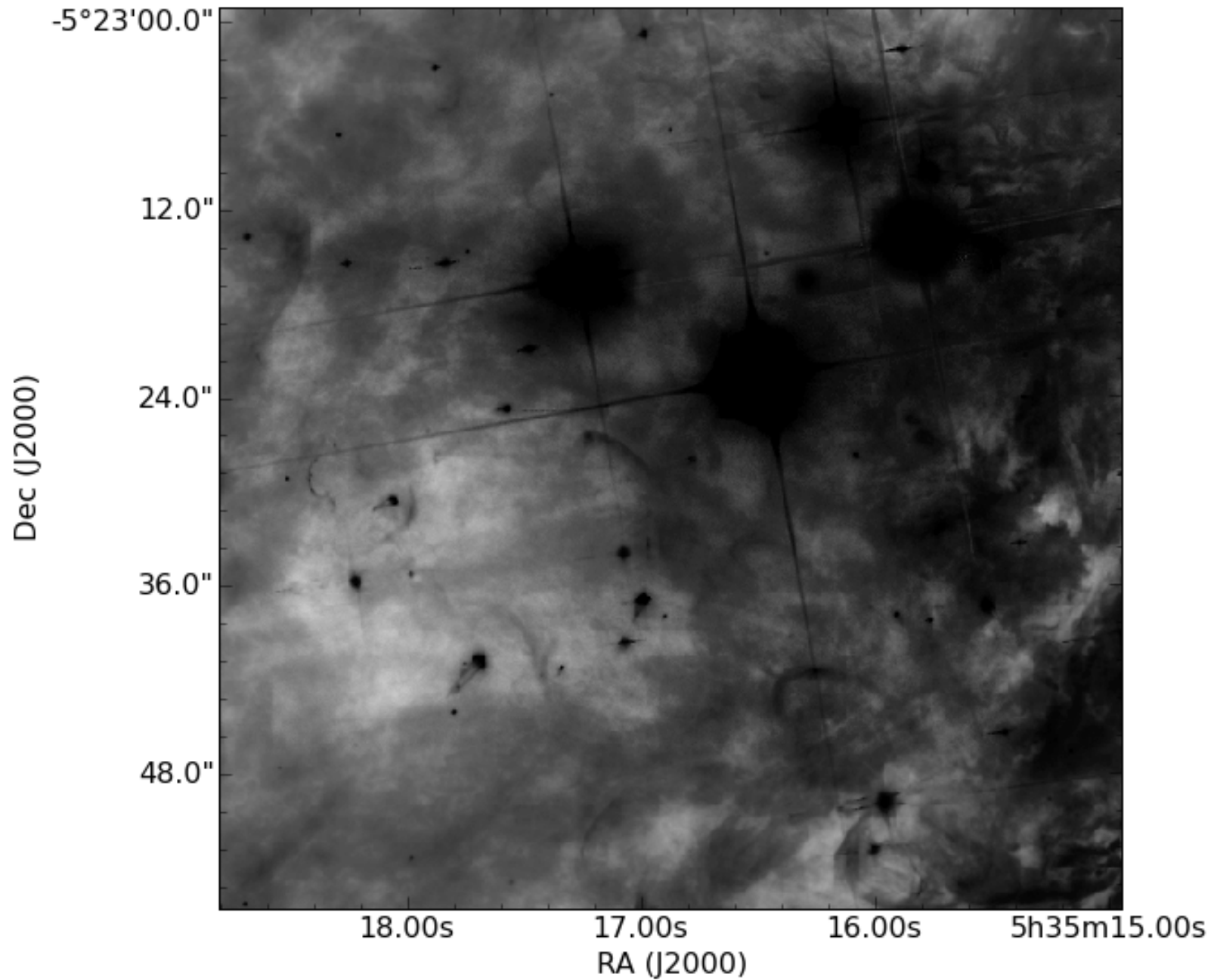


This is a **VLA image** of the Trapezium and the main proplyds!

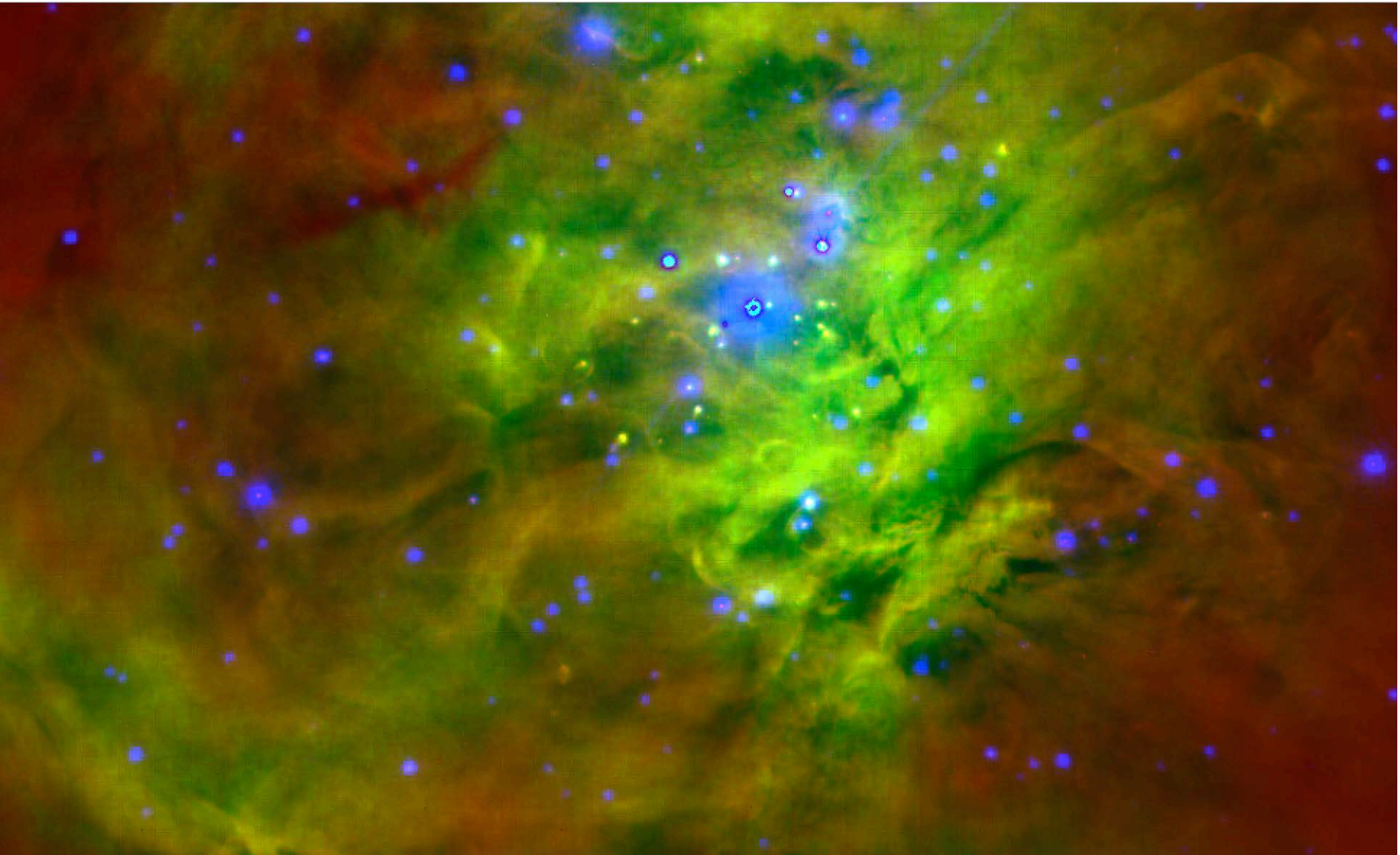


Forbrich et al. (2016); Forbrich, O'Dell, et al., *in prep.*

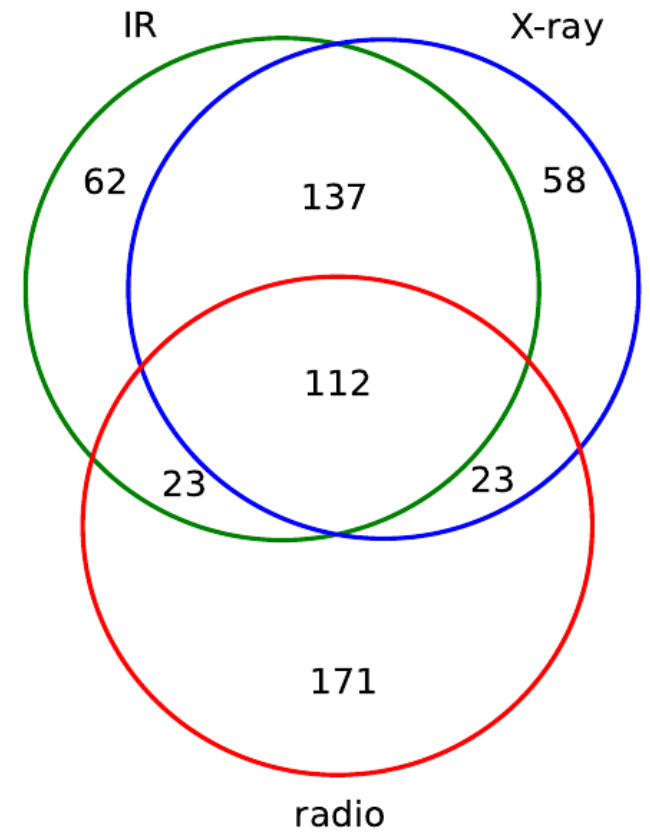
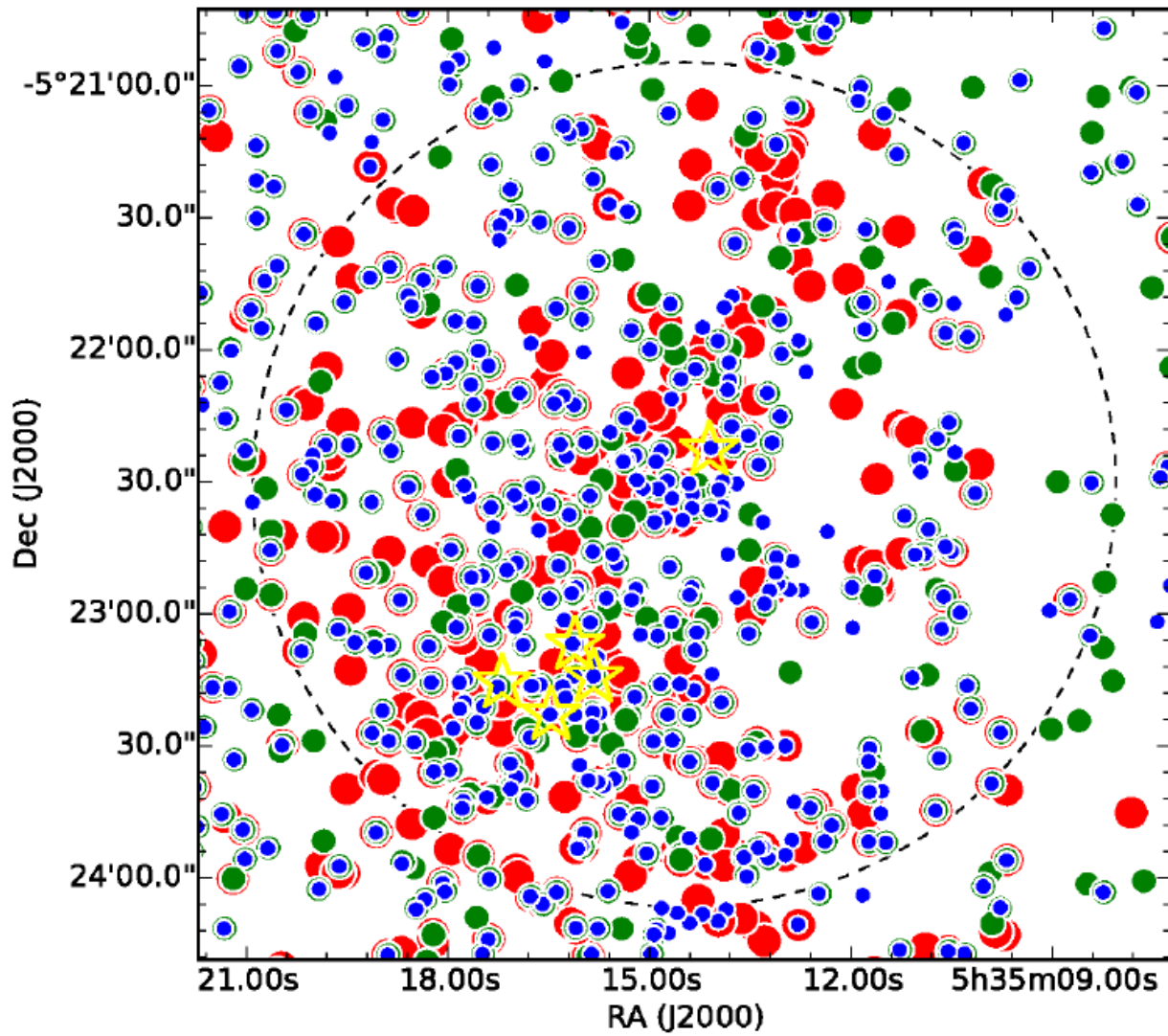
This is an **HST image** of the Trapezium and the main proplyds!

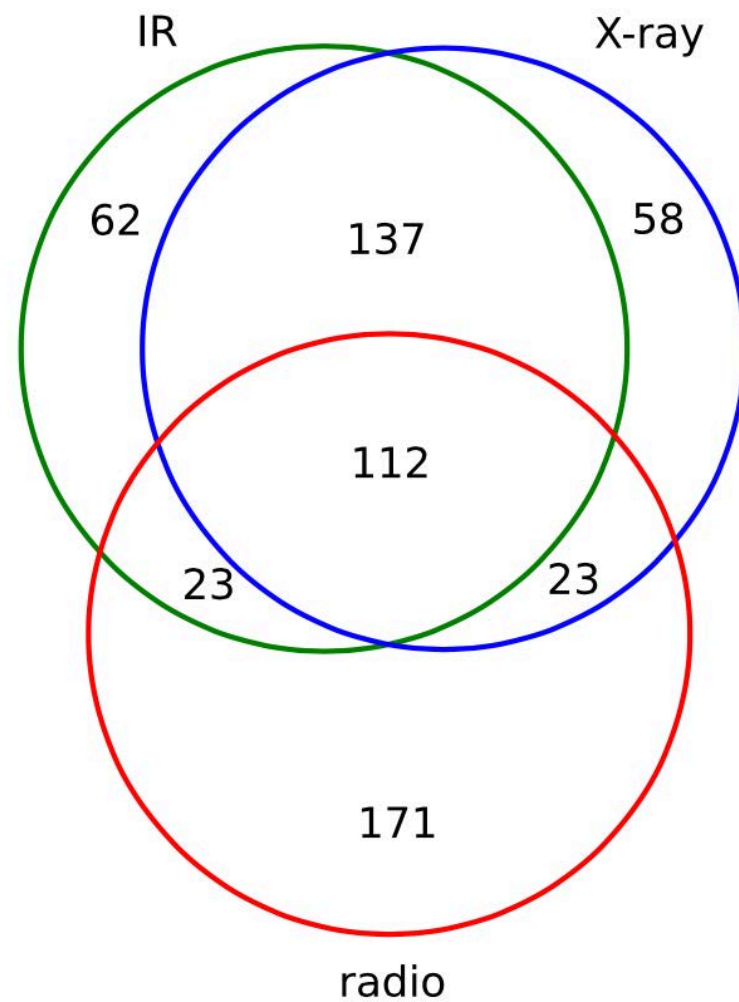
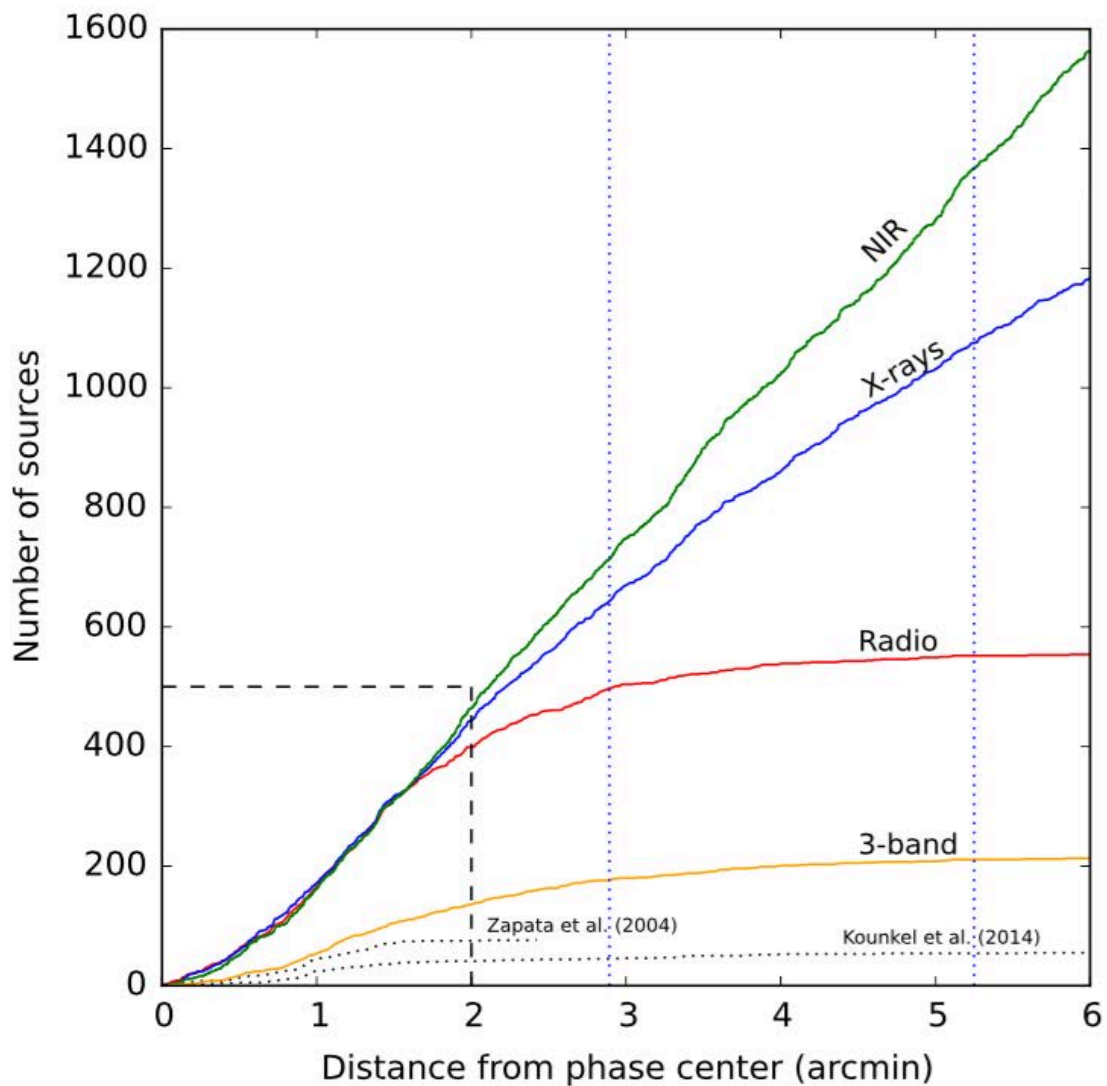


Forbrich et al. (2016); Forbrich, O'Dell, et al., *in prep.*

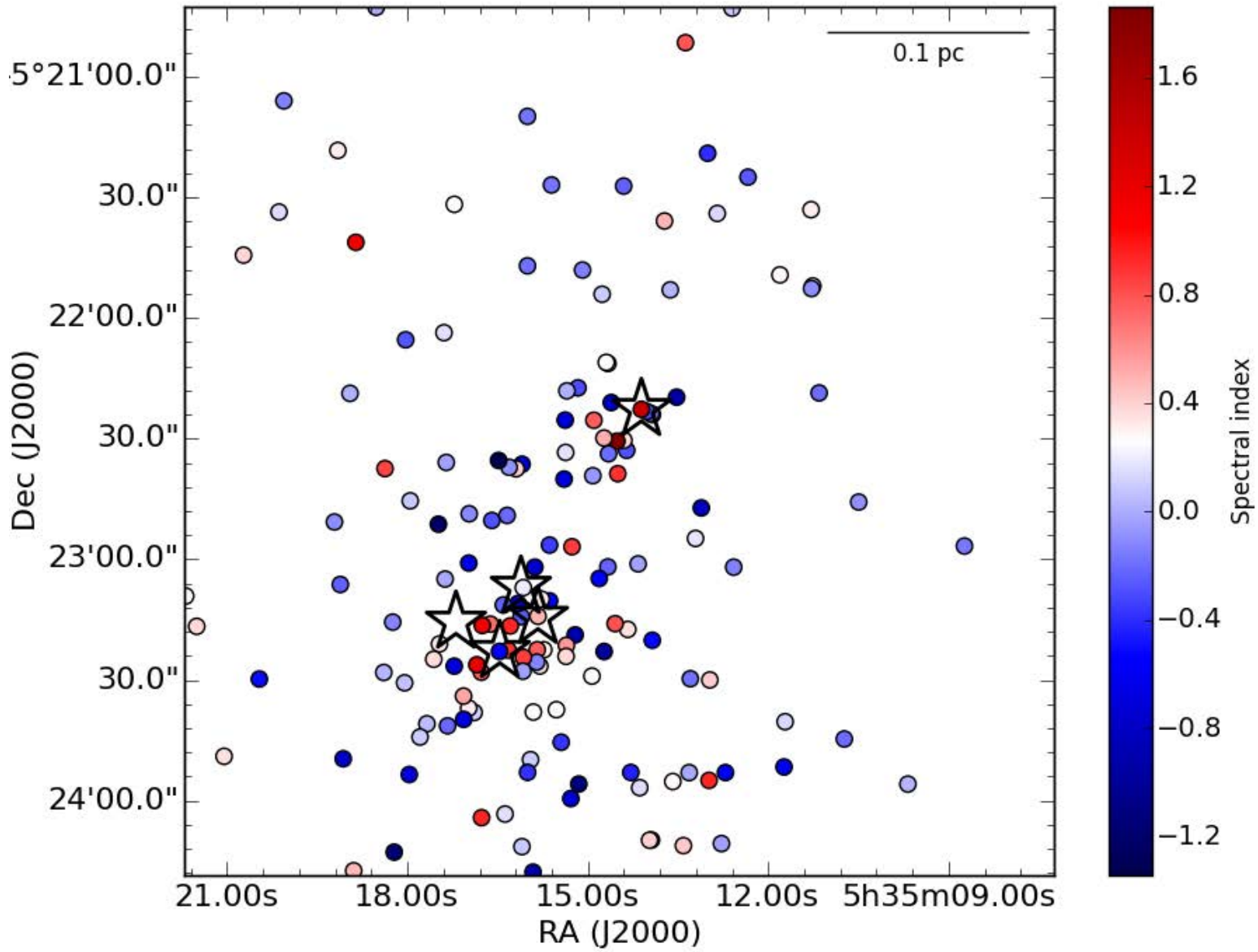


The radio-X-ray-infrared population

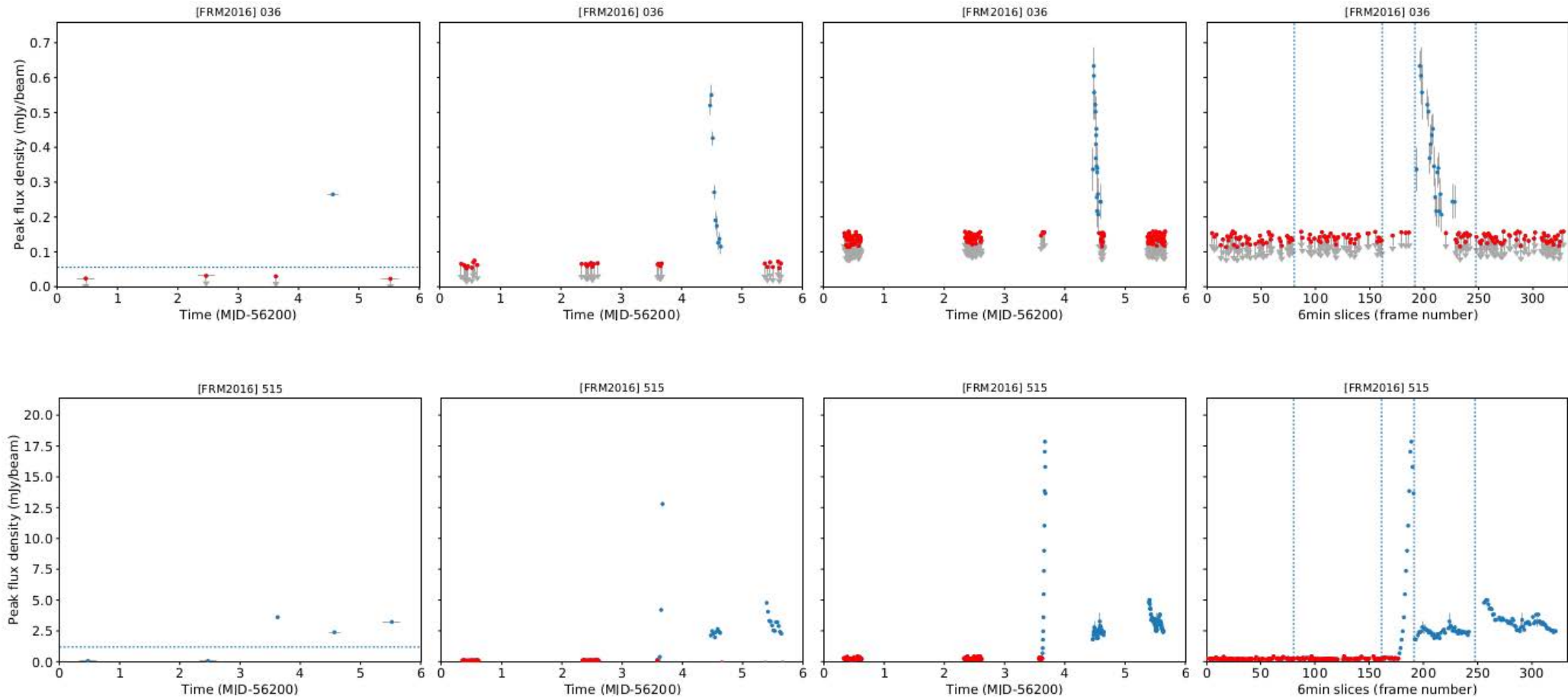




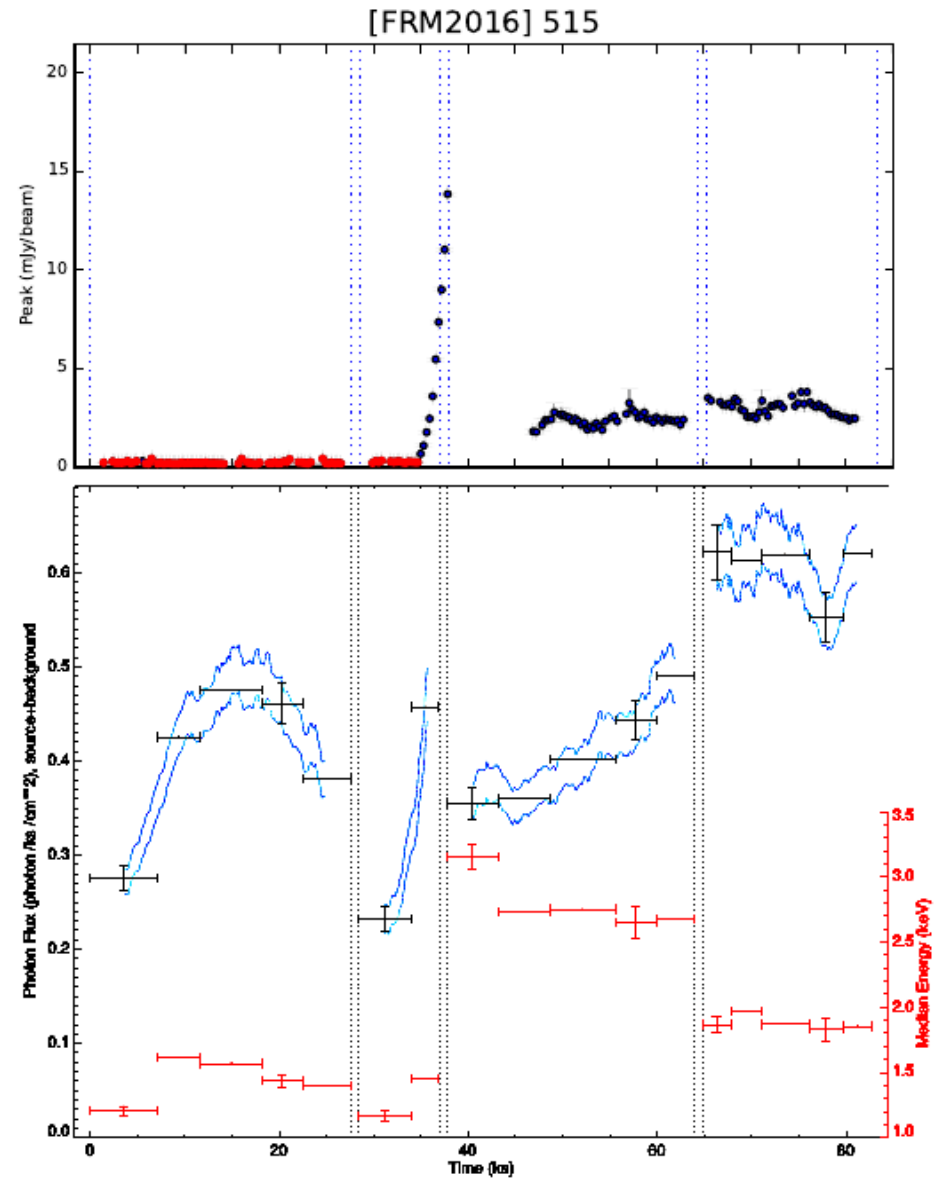
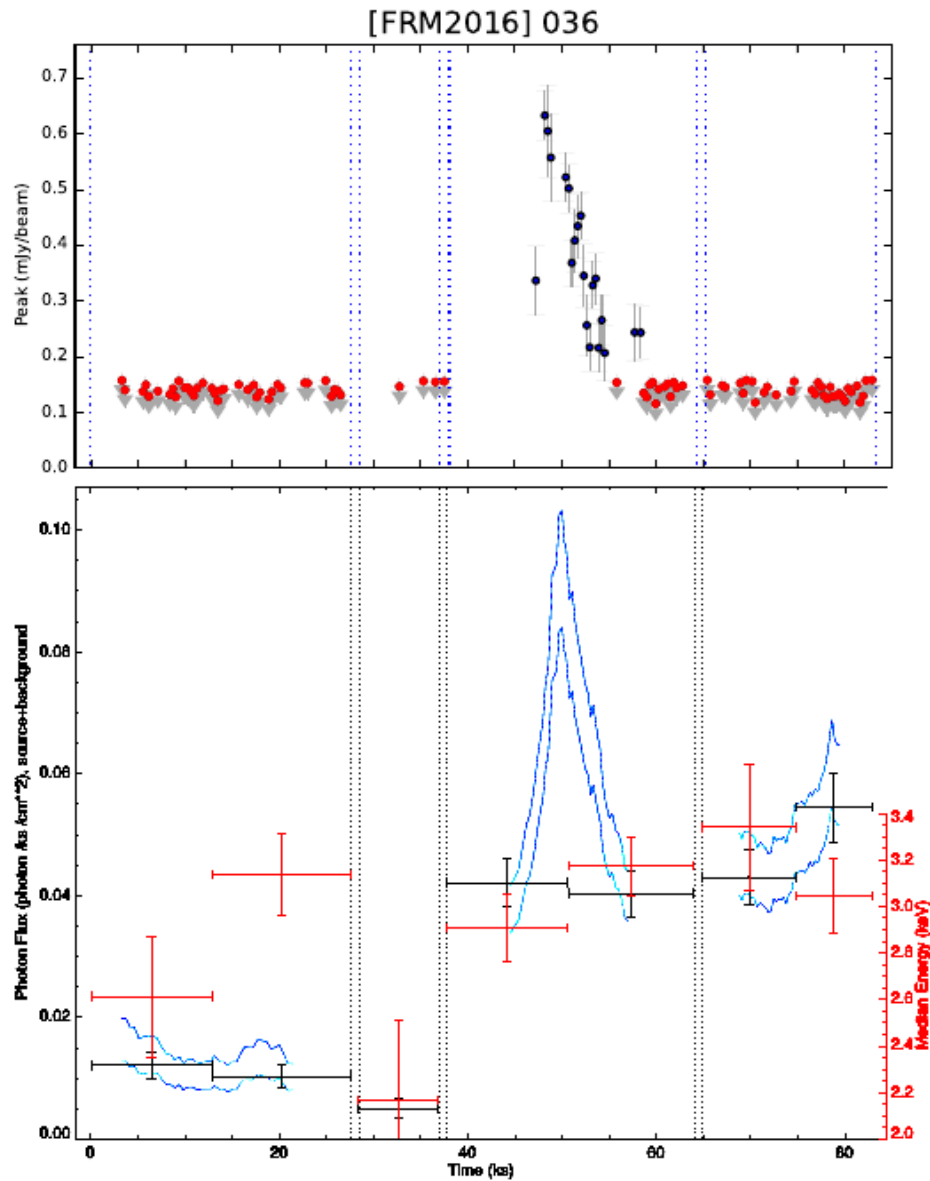
Radio spectral indices



Exploring YSOs in the radio **time domain**



Exploring YSOs in the radio – X-ray time domain



Status

- Detected 556 radio sources in 30 hours of JVLA pointed at the ONC.
- Spectral types O-M
- This is similar to the number of X-ray and IR sources in the field but the overlap is 1/3, 1/3, 1/3.
- 13 show extreme radio variability some on timescales < 1 hour which appear accompanied by X-ray flares
- On the other hand 5 of the extreme radio variables have no X-ray variability
- All extreme radio variables are X-ray sources.

... next steps

- Analyze the relationship between the radio and optical proplyds.
- We have now followed up all 556 VLA detections with the VLBA, a **data record** for the VLBA (Forbrich et al., *in prep.*).
- Relate the spectral indices to the objects
- Finish analysis of 2016 Program: wider field and simultaneous NuStar and Chandra data looking for hard flares.
- Actually look at the GB relation for these stars.