Physics 224
The Interstellar Medium

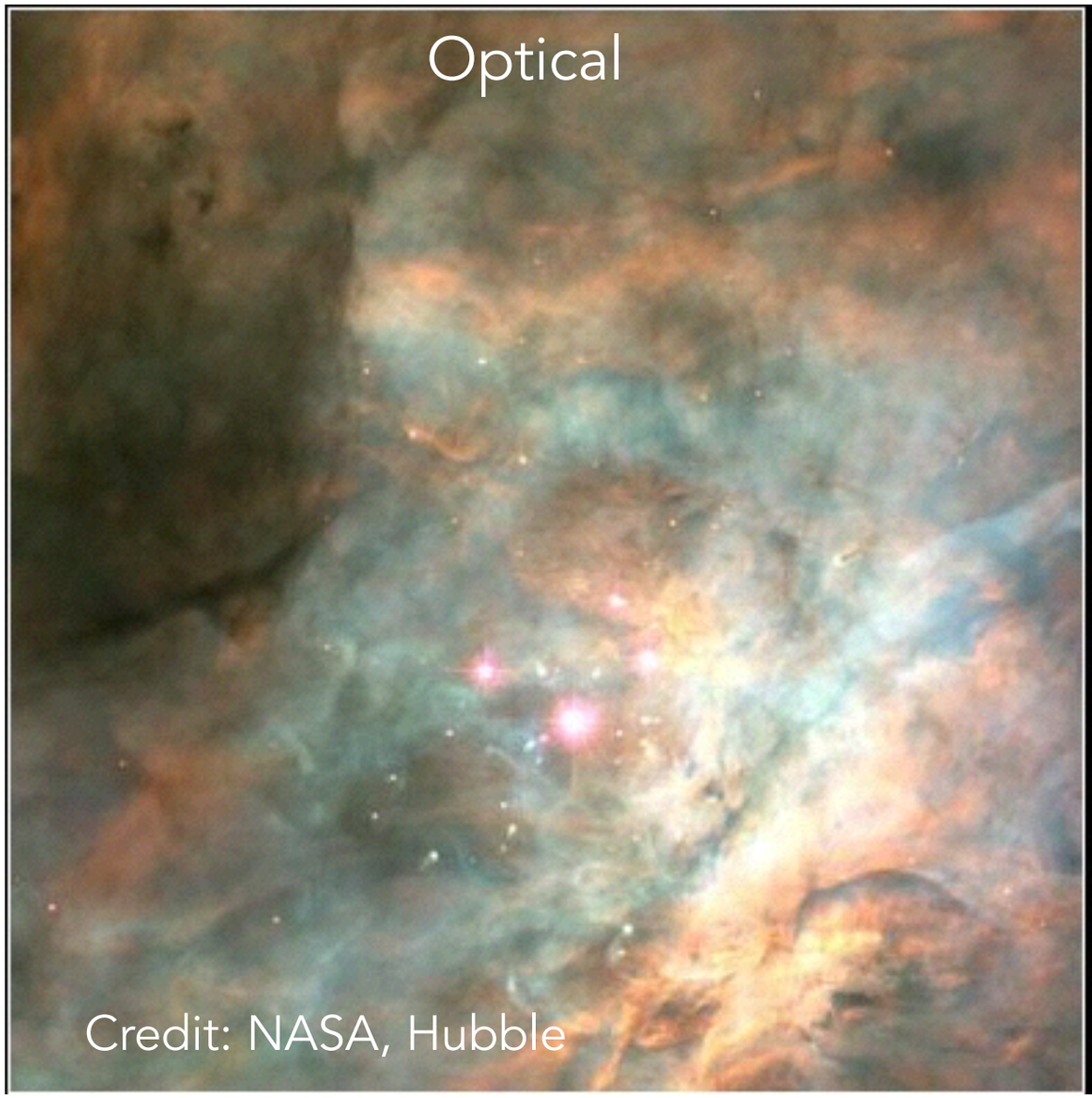
Last day!

Orion Nebula Meta-Study

Credit: NASA,ESA, M. Robberto (Space Telescope Science Institute/ESA)
and the Hubble Space Telescope Orion Treasury Project Team

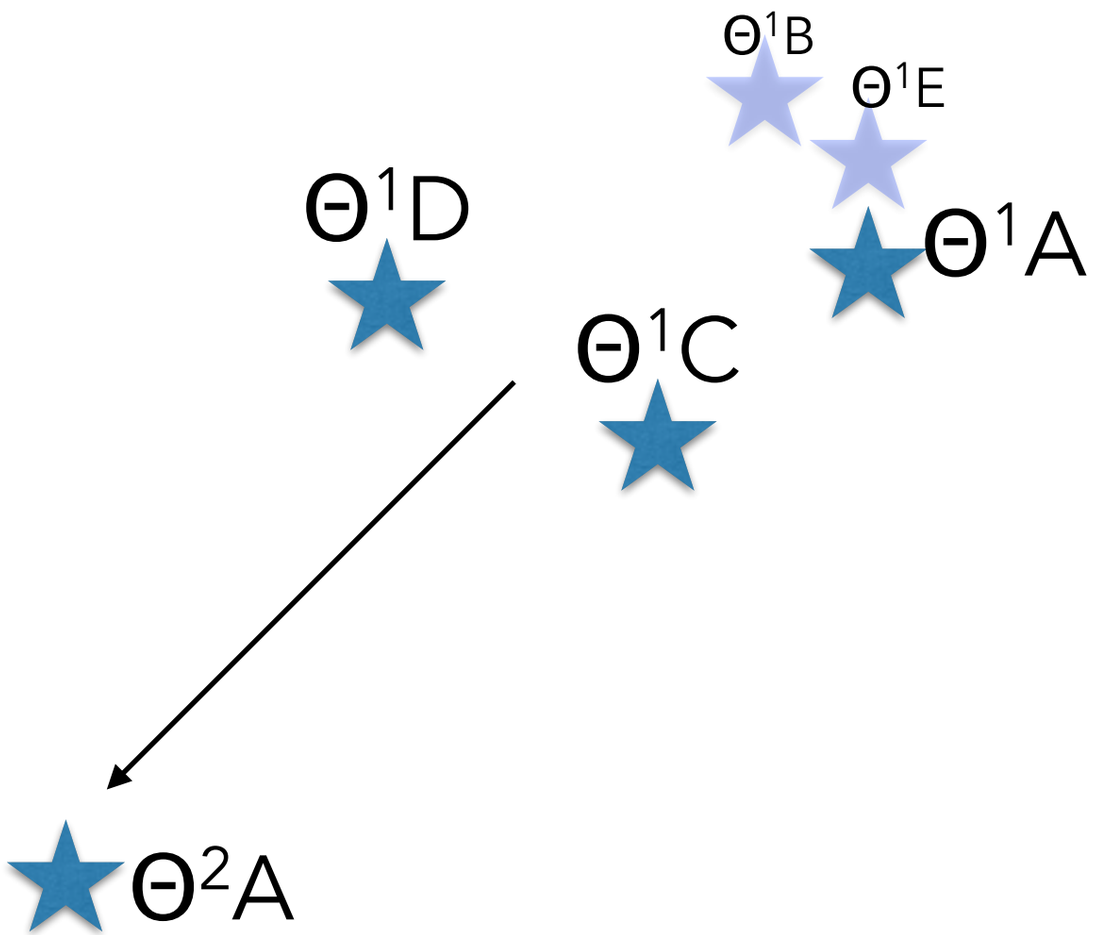
Orion Nebula Meta-Study

1. Which star or stars are responsible for ionizing gas in the Orion Nebula. What are the spectral types of the star or stars in question? What is their ionizing photon production rate?



Orion Nebula Meta-Study

1. Which star or stars are responsible for ionizing gas in the Orion Nebula. What are the spectral types of the star or stars in question? What is their ionizing photon production rate?



Orion Nebula Meta-Study

1. Which star or stars are responsible for ionizing gas in the Orion Nebula. What are the spectral types of the star or stars in question? What is their ionizing photon production rate?

Draine's Table:

Star	Spectral Type	Ionizing Photons per second
Θ^1 Ori C	O7V	5.6×10^{48}
Θ^2 Ori A	O9V	1.15×10^{48}
Θ^1 Ori D	O9.5V	0.76×10^{48}
Θ^1 Ori A	B0.5V	0.1×10^{48}
Total		7.61×10^{48}

Orion Nebula Meta-Study

1. Which star or stars are responsible for ionizing gas in the Orion Nebula. What are the spectral types of the star or stars in question? What is their ionizing photon production rate?

Class Average

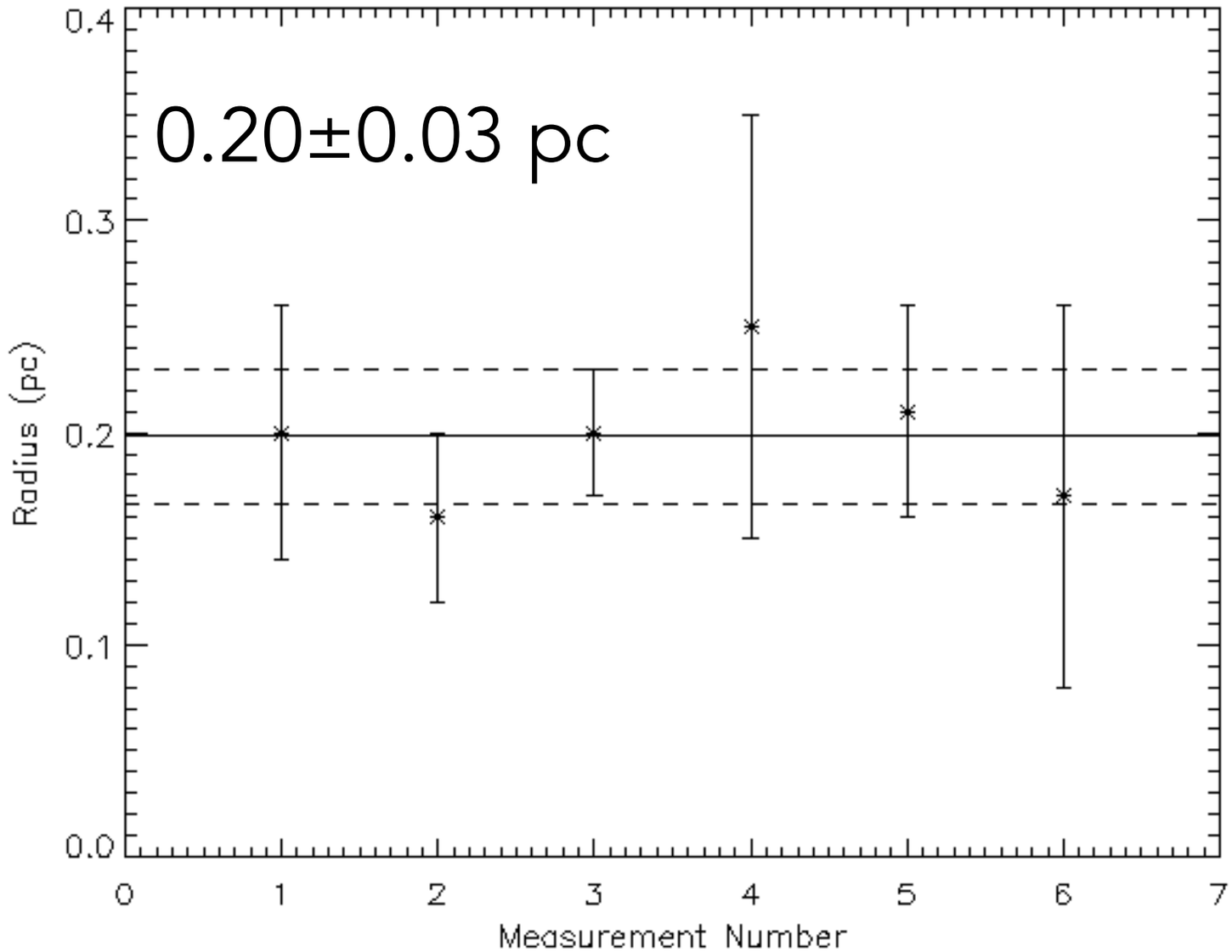
Person #	Total Ionizing Photon Rate
1	7.6×10^{48}
2	1.0×10^{49}
3	7.6×10^{48}
4	6.4×10^{48}
5	7.6×10^{48}
6	7.6×10^{48}
average	7.8×10^{48}

Orion Nebula Meta-Study

3. Measure the radius of the Orion Nebula using an Hα image of the region.

(

Person #	Ra
1	0.20±
2	0.16±
3	0.20±
4	0.25±
5	0.21±
6	0.17±
average	0.20±



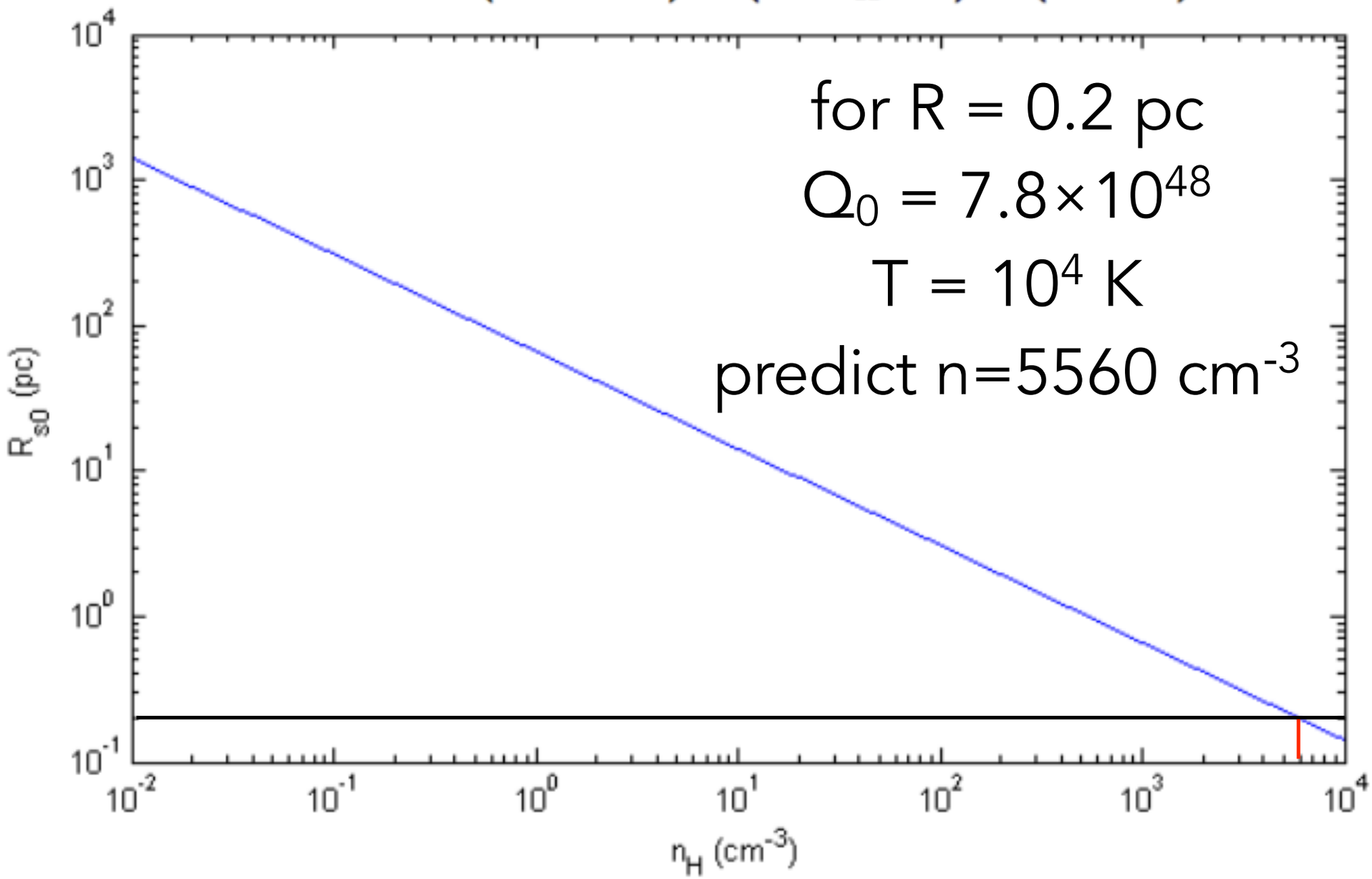
Orion Nebula Meta-Study

4. Compare your measured size to the predictions from your Stromgren sphere estimate. What density would you need to make the radius of the Orion Nebula agree with the Stromgren sphere prediction?

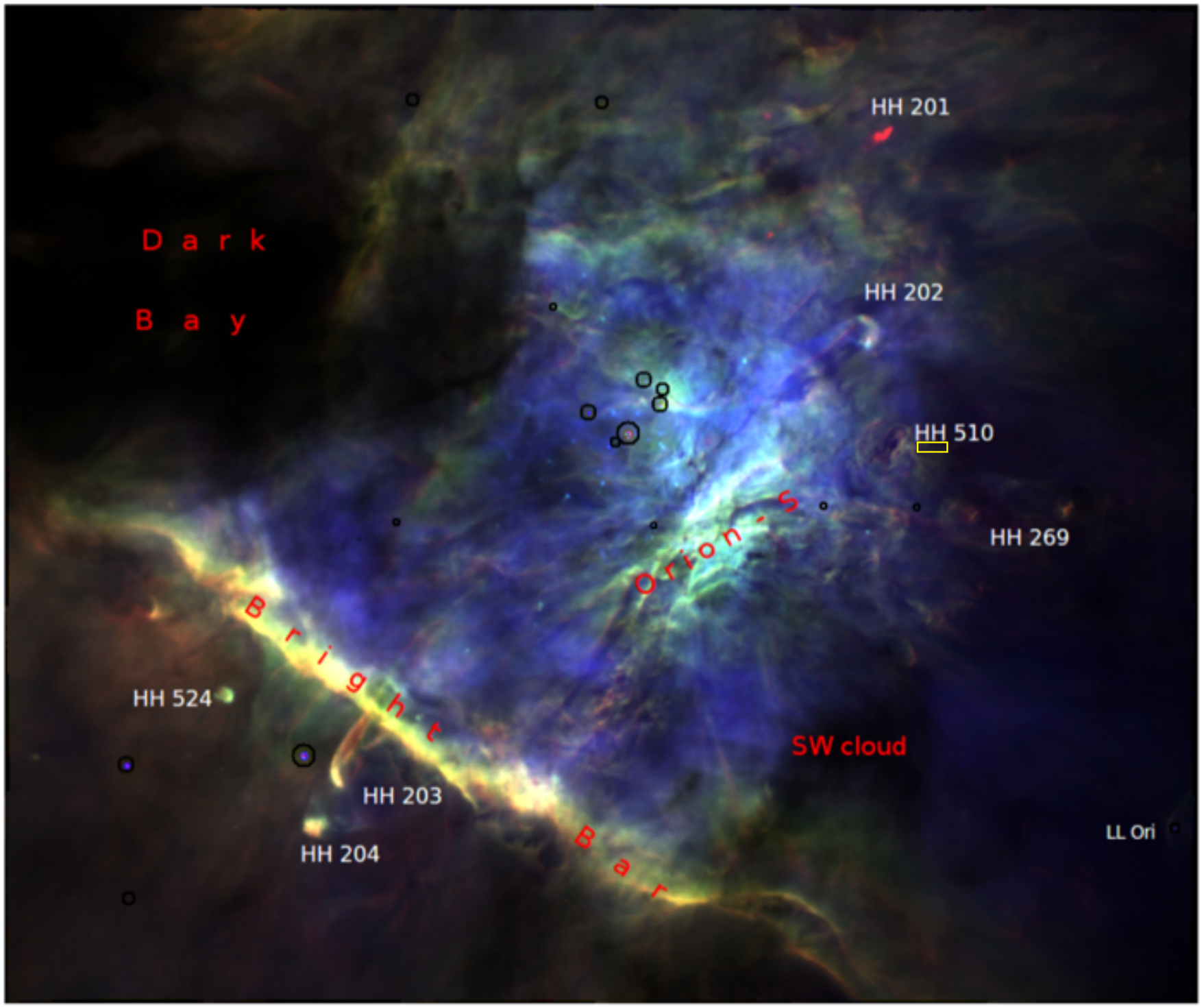
Person #	Necessary Density
1	3600-8800 cm^{-3}
2	460-1700 cm^{-3}
3	1288-1738 cm^{-3}
4	1.2×10^{4}-6.0×10^{4} cm^{-3}
5	3400-7000 cm^{-3}
6	6000-18000 cm^{-3}
Average	~5000 cm^{-3} (w/o one outlier)

Orion Nebula Meta-Study

$$R = 9.77 \times 10^{18} \left(\frac{Q_0}{10^{49}\ s^{-1}} \right)^{\frac{1}{3}} \left(\frac{10^2\ cm^{-3}}{n_H} \right)^{\frac{2}{3}} \left(\frac{T}{10^4\ K} \right)^{0.28} cm$$



Orion Nebula Meta-Study



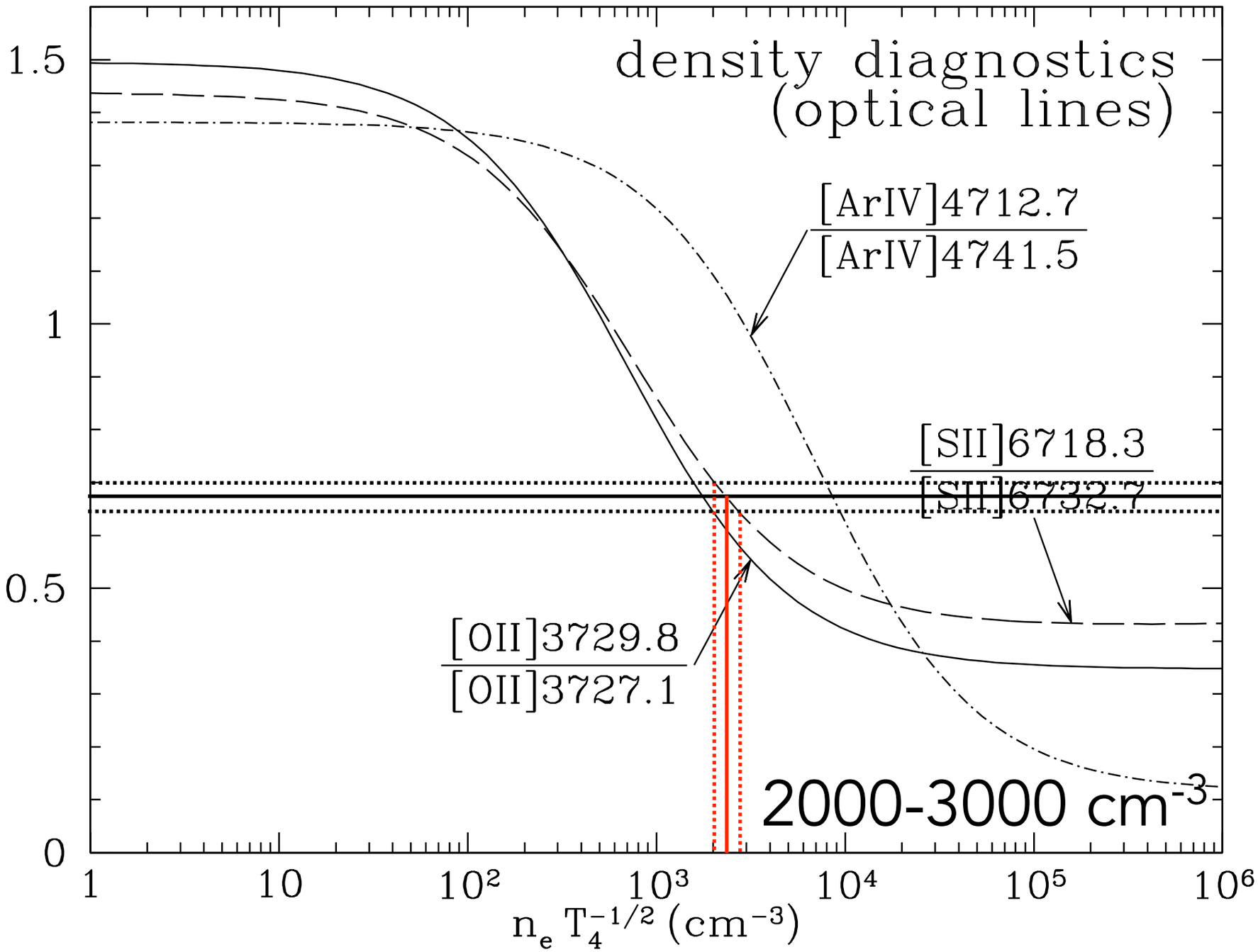
Orion Nebula Meta-Study

3. Measure the radius of the Orion Nebula using an Hα image of the region.

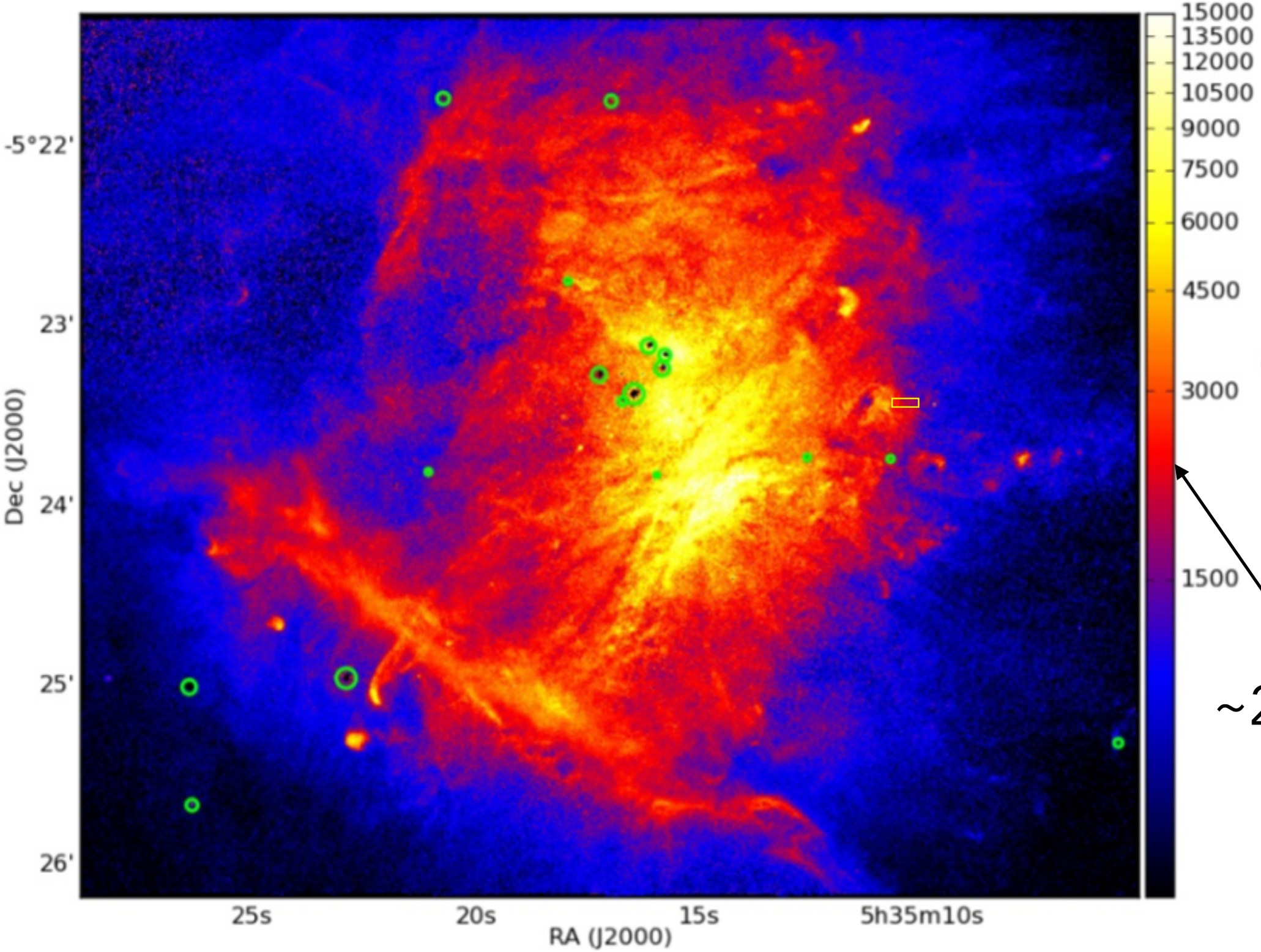
Class Average

Person #	Measured n	Line Ratio (SII 6718/6733)
1	1000 cm^{-3}	0.696
2	1.29-5.72×10^4 cm^{-3}	0.69±0.12
3	3162 cm^{-3}	0.673
4	2.55×10^4 cm-3	0.631±0.125
5	2000-3500 cm^{-3}	0.665
6	2500 cm^{-3}	0.70±0.29
average		0.675±0.026

Orion Nebula Meta-Study



Orion Nebula Meta-Study



~2000 cm^{-3}