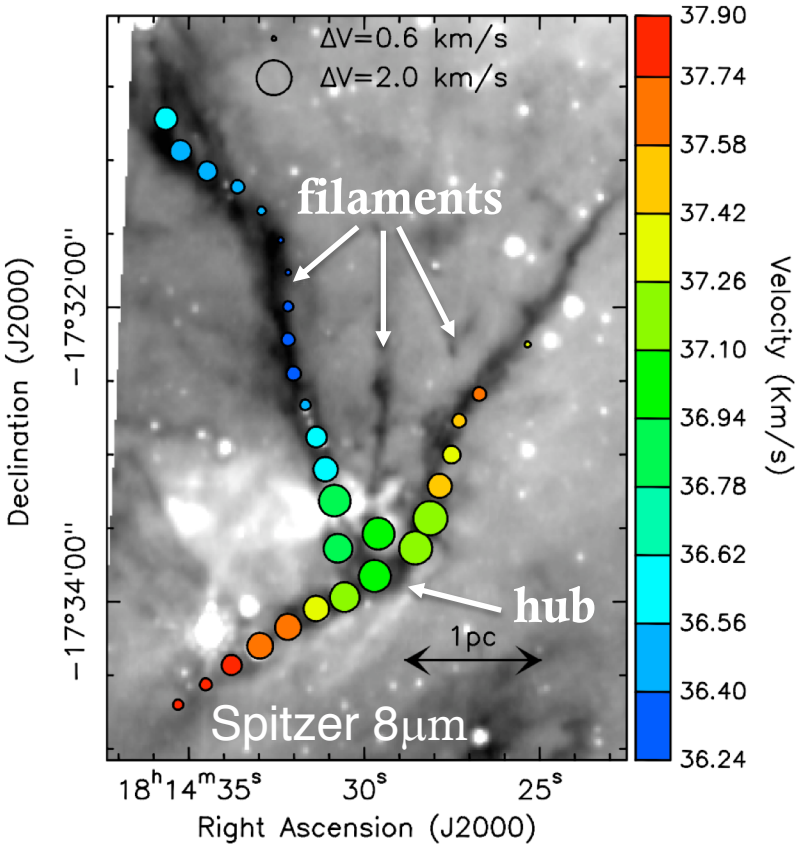
Role of hub-filament systems in the formation of massive stars

Do the most massive stars (>100Msun) form only in hubs?

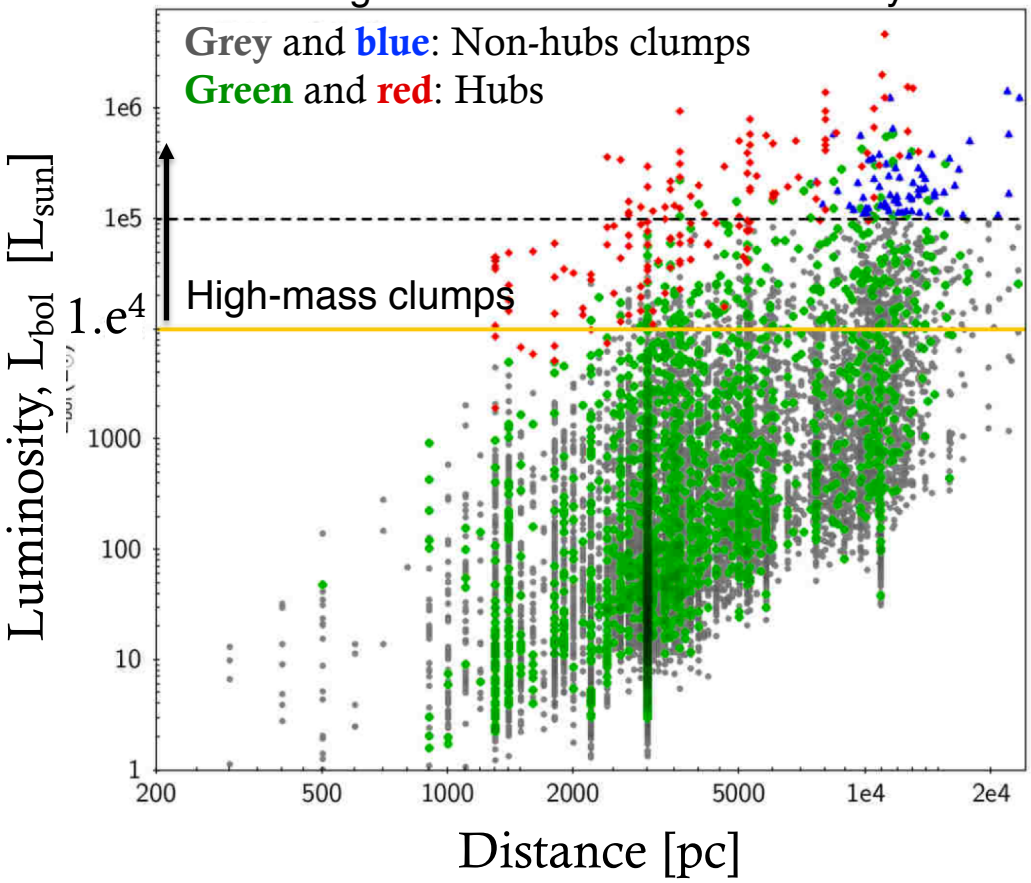
Flows along filaments: - Increase the mass and density of the hubs
- Generate turbulent supports and "super-Jeans" mass cores

Hubs at the intersection of multiple filaments host star clusters (with massive stars)



e.g., Myers 2009, Schneider et al. 2012
Peretto et al. 2013, 2014, and others

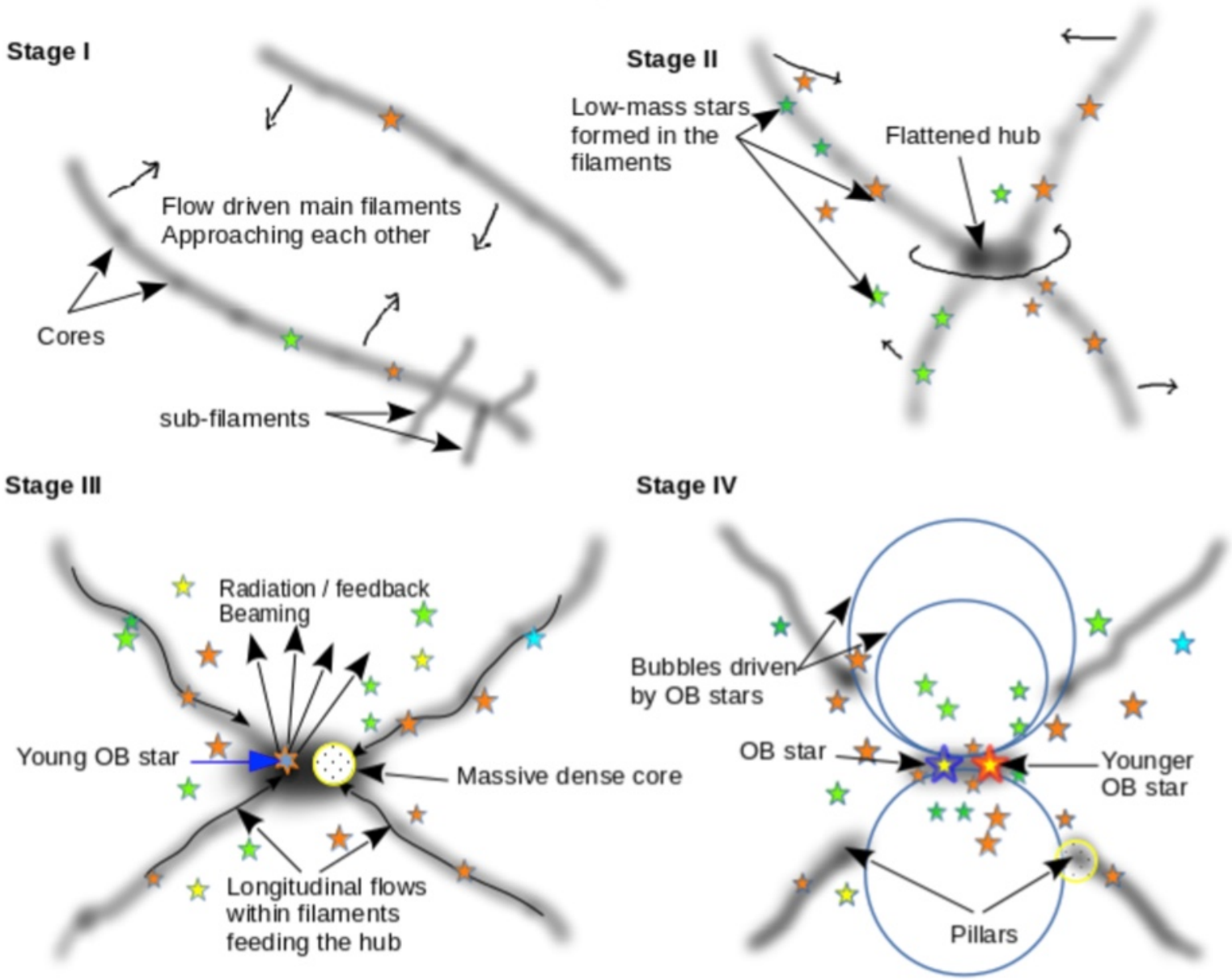
Statistical analysis of the filamentary environment of ~ 10^5 clumps in the Galactic plane from the catalog of the Herschel Hi-Gal survey



Kumar et al. 2020

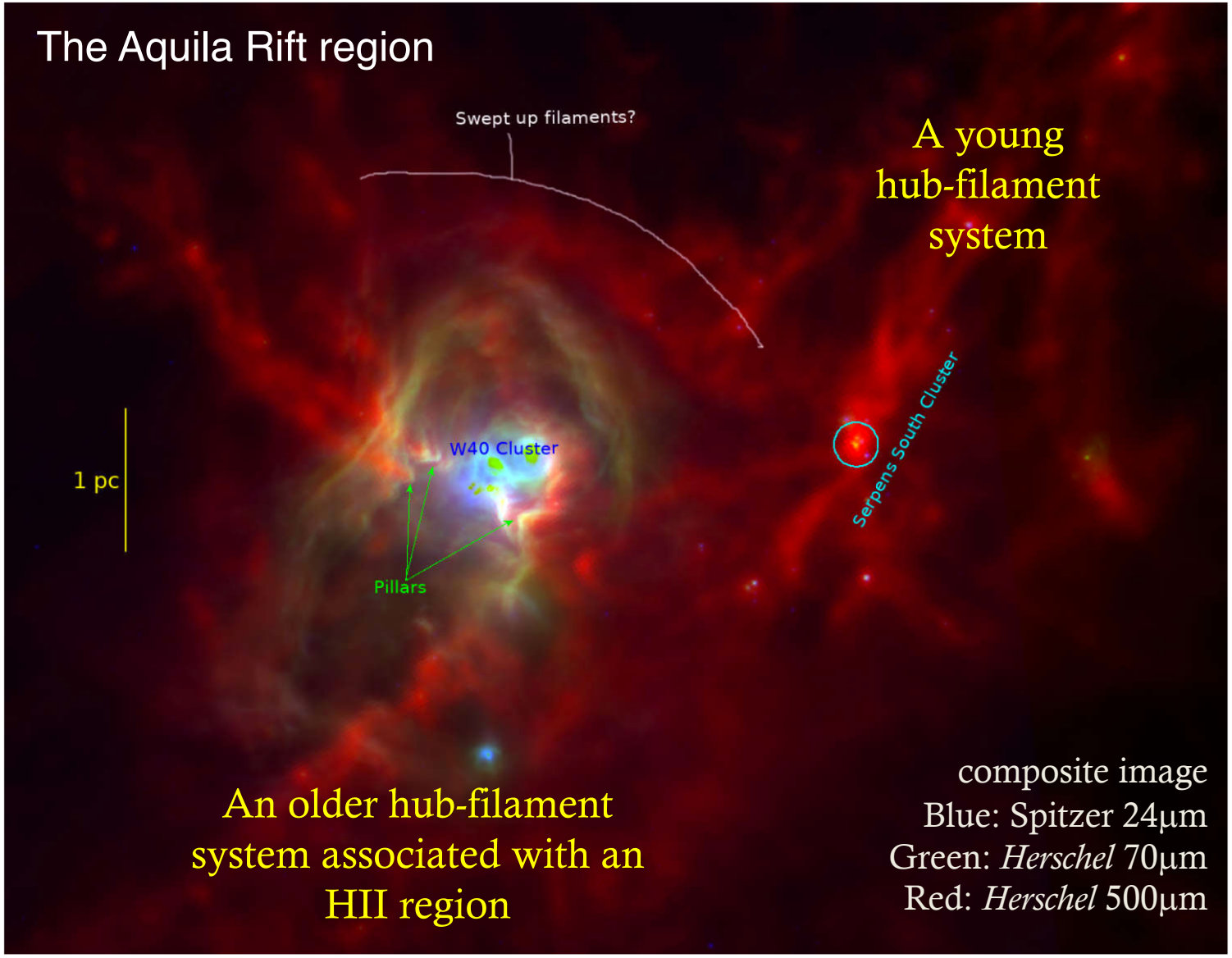
Hub-filament Paradigm for star formation: Filaments to Clusters

Kumar et al. 2020



Hub-filament systems at different evolutionary stages

Kumar et al. 2020



Hub-filament Paradigm for star formation: Filaments to Clusters

Kumar et al. 2020, 2021

Merit of this scenario:

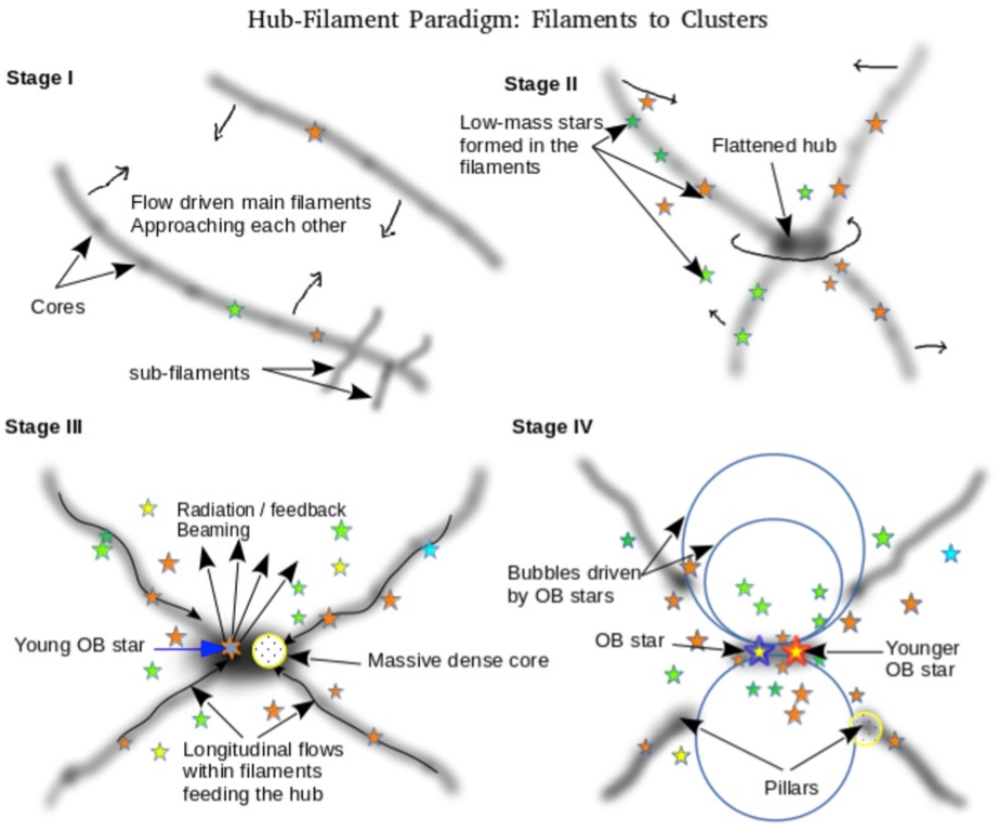
→ Formation time scales: low and-intermediate-mass stars form slowly (10^6 yr) in the filaments and massive stars form quickly (10^5 yr) in the hub

→ Origin of the IMF: The initial mass function could be the combination of stars continuously formed in the hub-filament system with all massive stars formed in the hub

→ Feedback dissipation

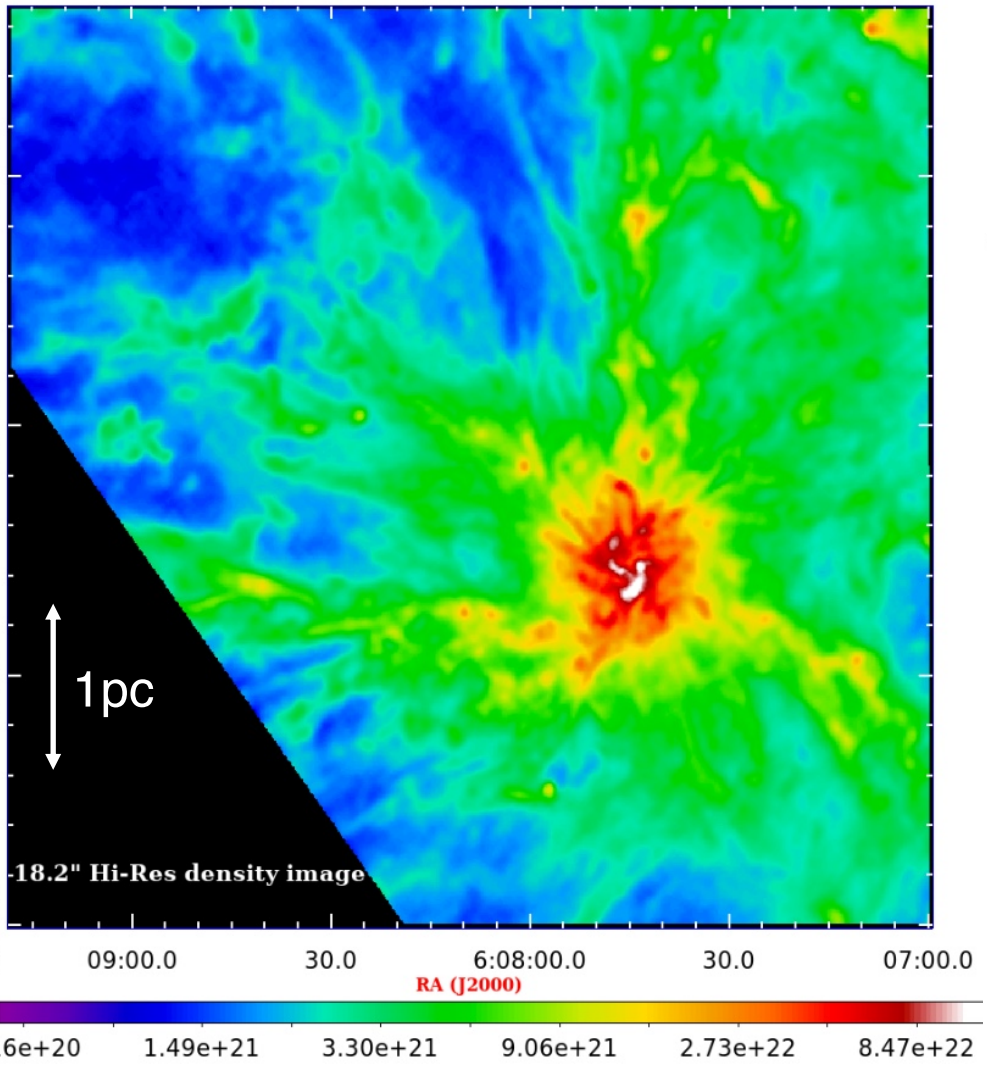
→ Mass segregation due to HFS properties

→ Age spread of stars



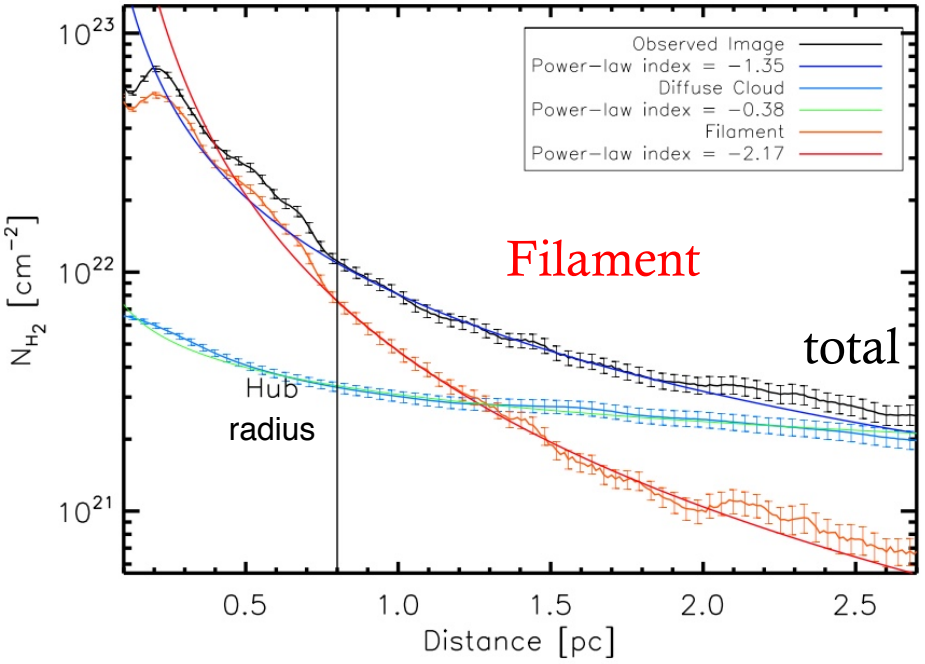
The MonR2 hub-filament system

Herschel column density map



Kumar et al. 2021, sub.

Radial profiles centered on the hub



Radius (pc)	0.4 (core)	0.8 (hub)	1.6	2.5
	Mass $M_\odot$			
Filament	688	1313	1832	2115
Diffuse cloud	89	251	732	1434
Sources	135	229	314	372
Total	912	1794	2879	3921
	Mass fraction %			
Filament	75	73	64	54
Diffuse cloud	10	14	25	37
Sources	15	13	11	9