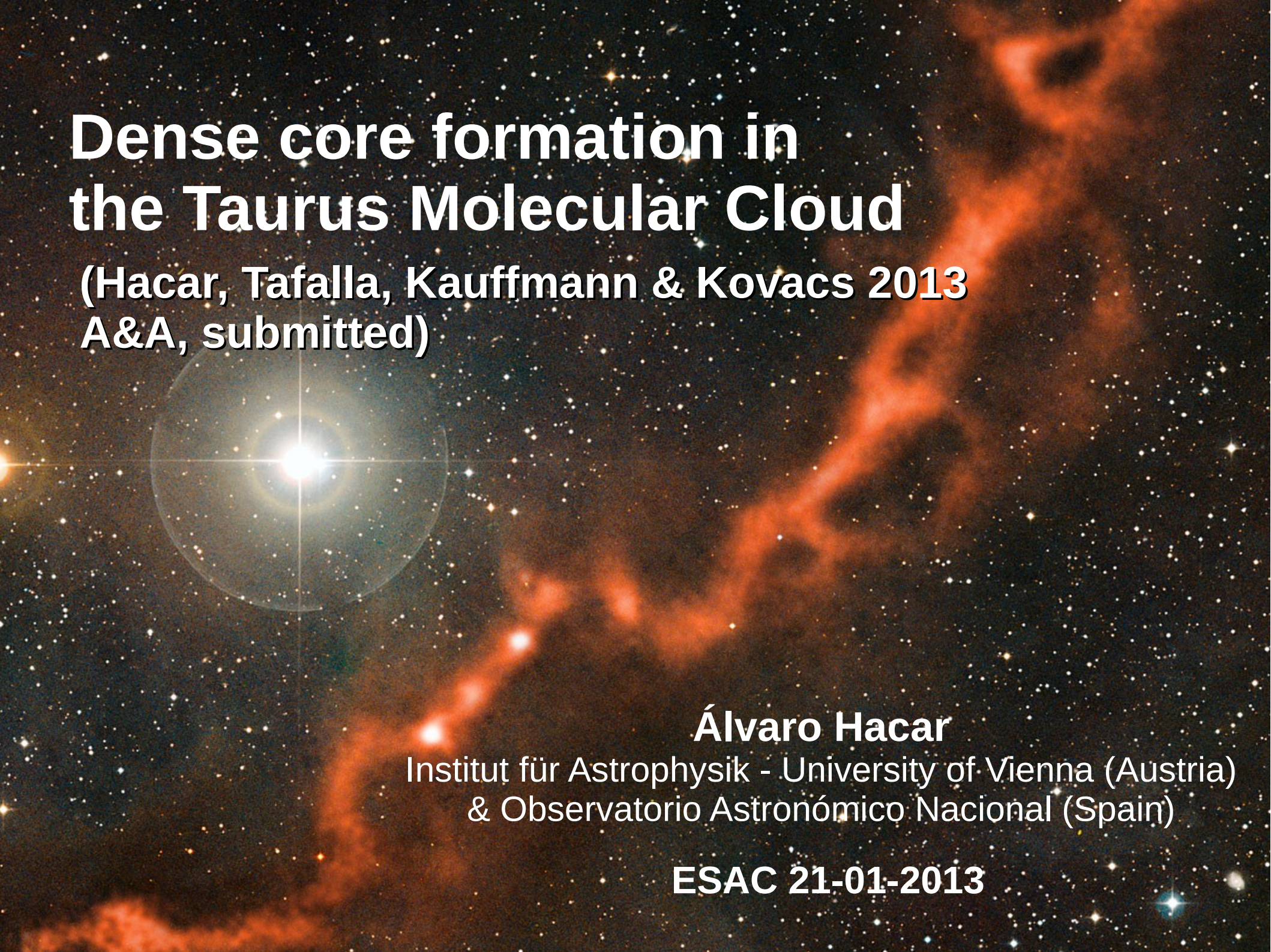

Dense core formation in the Taurus Molecular Cloud

(Hacar, Tafalla, Kauffmann & Kovacs 2013 A&A, submitted)

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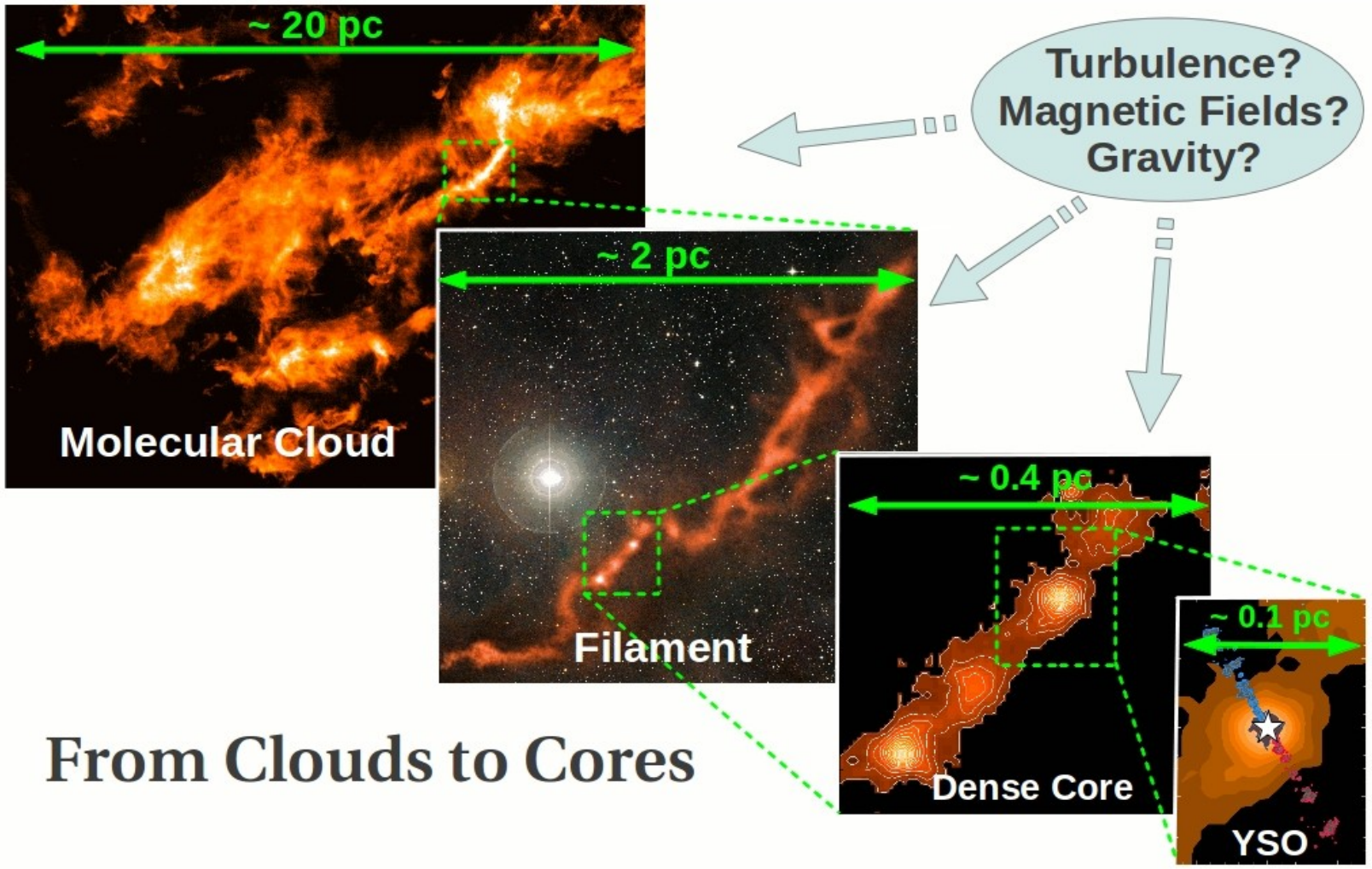
ESAC 21-01-2013

Dense core formation within molecular clouds

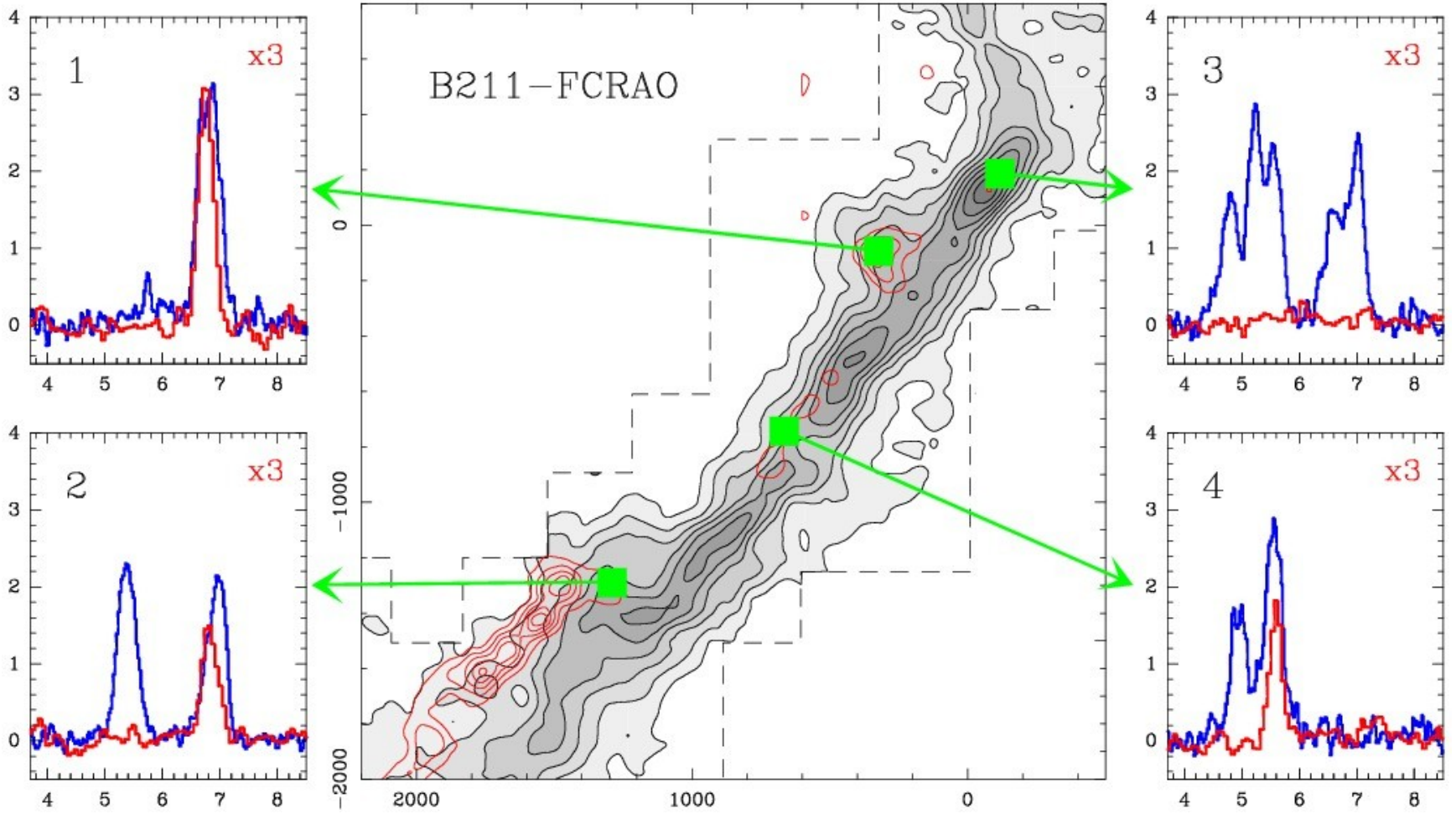


Images: Goldsmith et al 2008; Hacar, Tafalla & Pierce-Price 2012; Hacar et al. 2012; Santiago-García et al 2009

- **Goal:** Detailed study of the dense cores formation within MC
- **Approach:** Connecting gas dynamics at different density regimes
- **Target:** Barnard 213 = representative SF region in Taurus

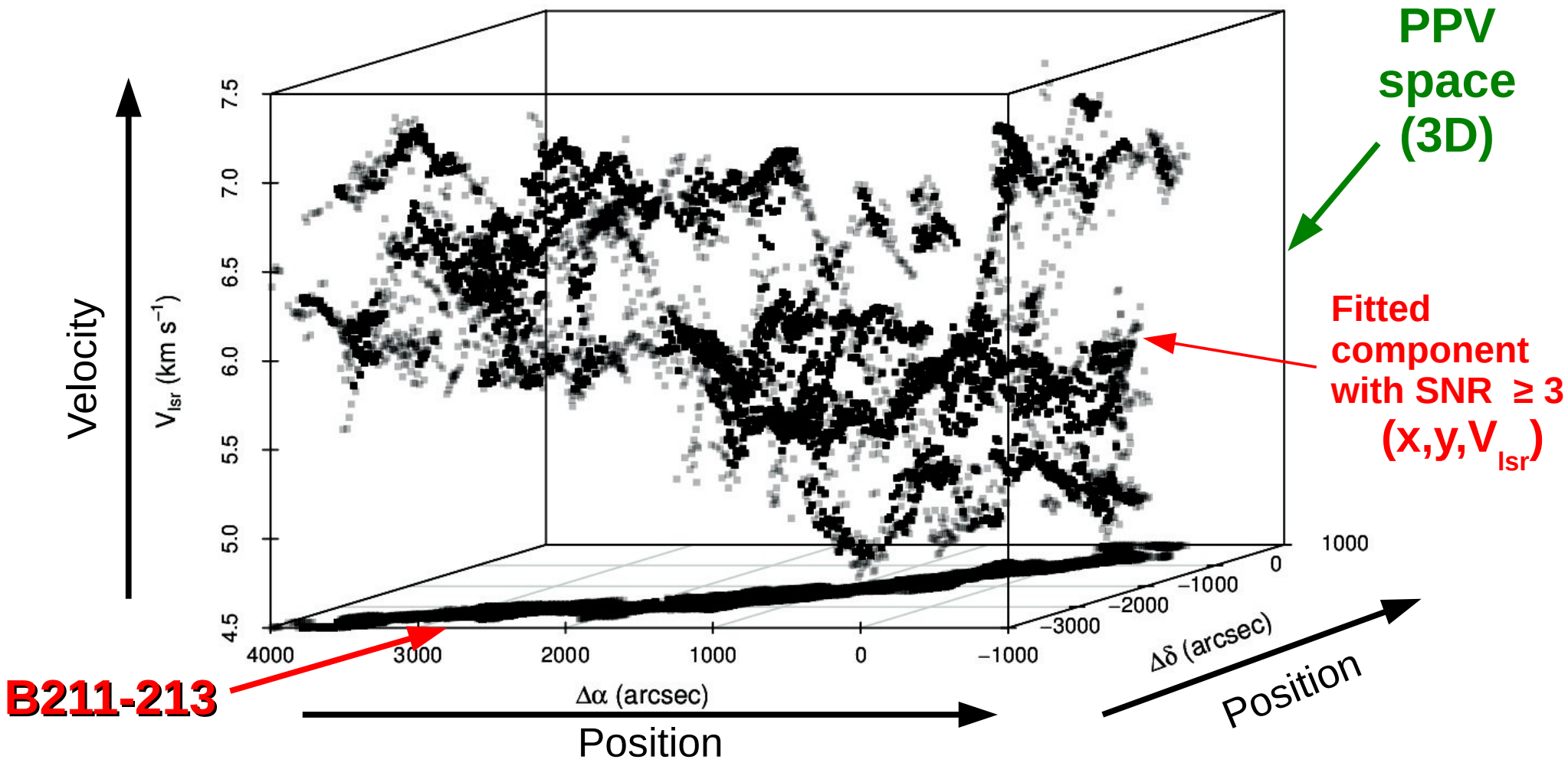
Complex kinematic structure in Barnard 213

N_2H^+ (red) + $C^{18}O$ (blue)



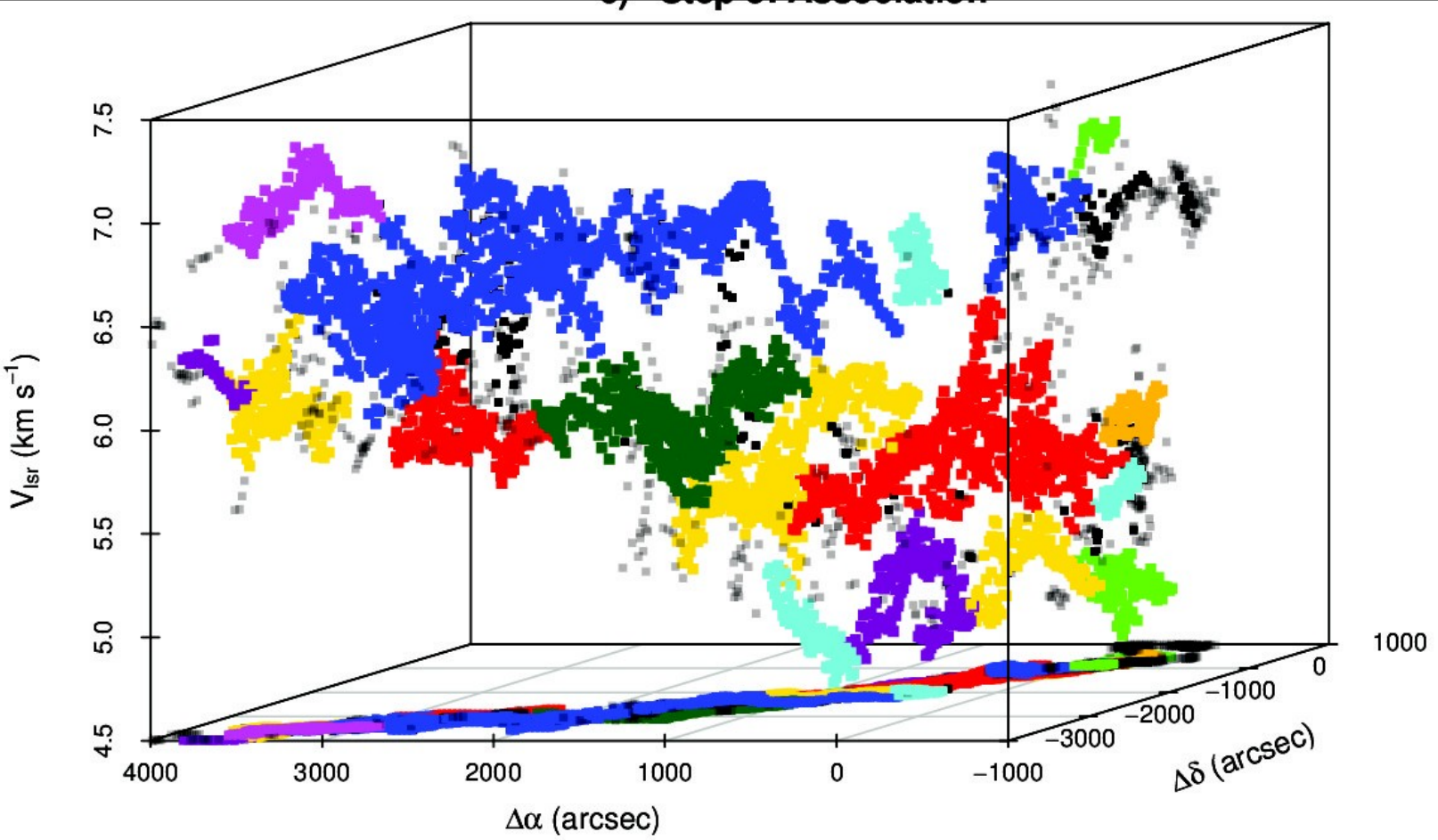
- Complex kinematic structure → up to 5 components along l.o.s. !
- Standard analysis techniques not valid
- **Friends-In-Velocity (FIVe) = New analysis technique**

Gaussian decomposition and PPV space



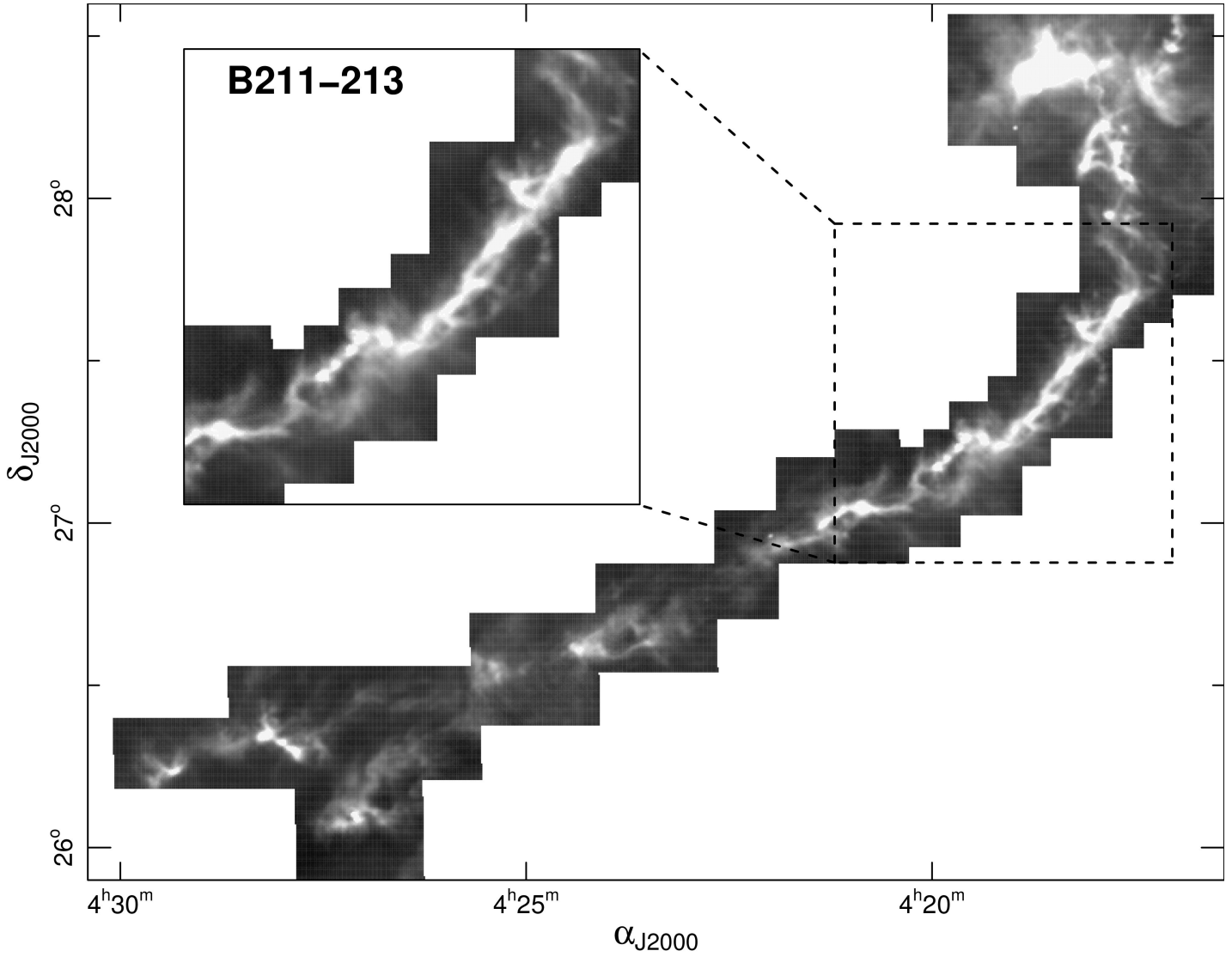
- Supervised and semiautomatic multicomponent fit
- Results: ~12.000 components fitted ($C^{18}O$ + N_2H^+) with SNR ≥ 3
- More convenient to study in the Position-Position-Velocity space (**PPV**)
- Components **highly structured in PPV**

New algorithm to identify velocity-coherent structures



- New algorithm based on a Friends-of-friends (FoF) approach (Huchra & Geller 1982) using a $|\nabla V_{lsr}|$ to connect points
- Results = **35 velocity-coherent filaments in Barnard 213 !! (see also Hacar & Tafalla 2011)**

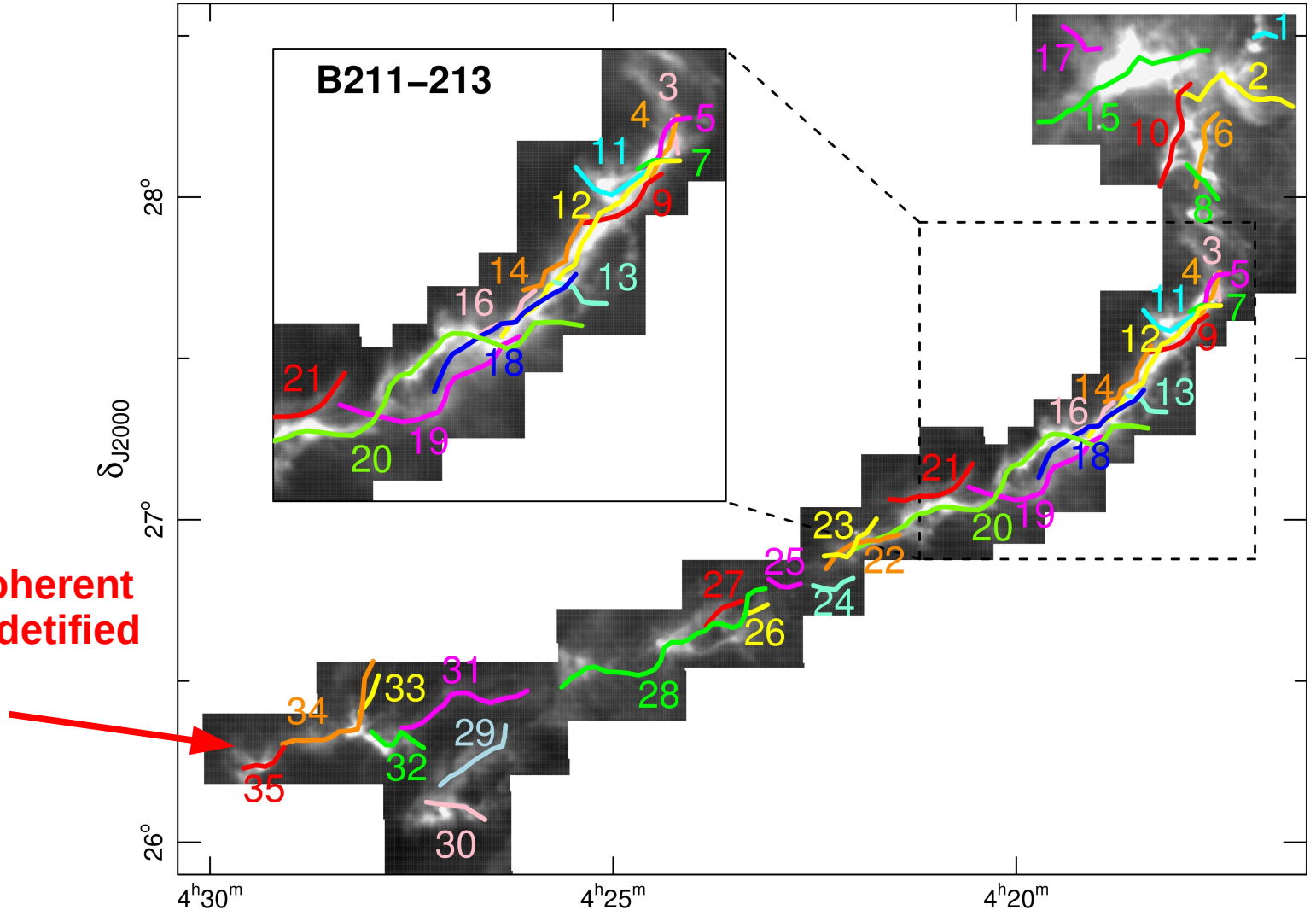
Velocity-coherent structures in Barnard 213 (II)



250μm Herschel-SPIRE archive image
Gould Belt project. PI: P. André
(Palmerin et al 2012)

- FIVe = Systematic analysis of the gas velocity structure within this region (> 12.000 components)

Velocity-coherent structures in Barnard 213 (II)



Velocity-coherent filaments idetified by FIVe

250μm Herschel-SPIRE archive image
Gould Belt project. PI: P. André
(Palmerin et al 2012)

- Barnard 213 = **35 velocity-coherent filaments forming a bundle**
- All the gas at $n(H_2)$ ~10^3-10^4 cm^{-3} is highly structured before the formation of the cores

Dense core formation in Taurus: Hierarchical fragmentation