



# The case of the Hydra I cluster core: kinematics and stellar populations

Carlos Eduardo Barbosa<sup>1,2</sup>, Michael Hilker<sup>1</sup>, Magda Arnaboldi<sup>1</sup>,  
Lodovico Coccato<sup>1</sup>, Cláudia Mendes de Oliveira<sup>2</sup>, Tom Richtler<sup>3</sup>

<sup>1</sup>ESO, <sup>2</sup>IAG-USP, <sup>3</sup>Universidad de Concepcion

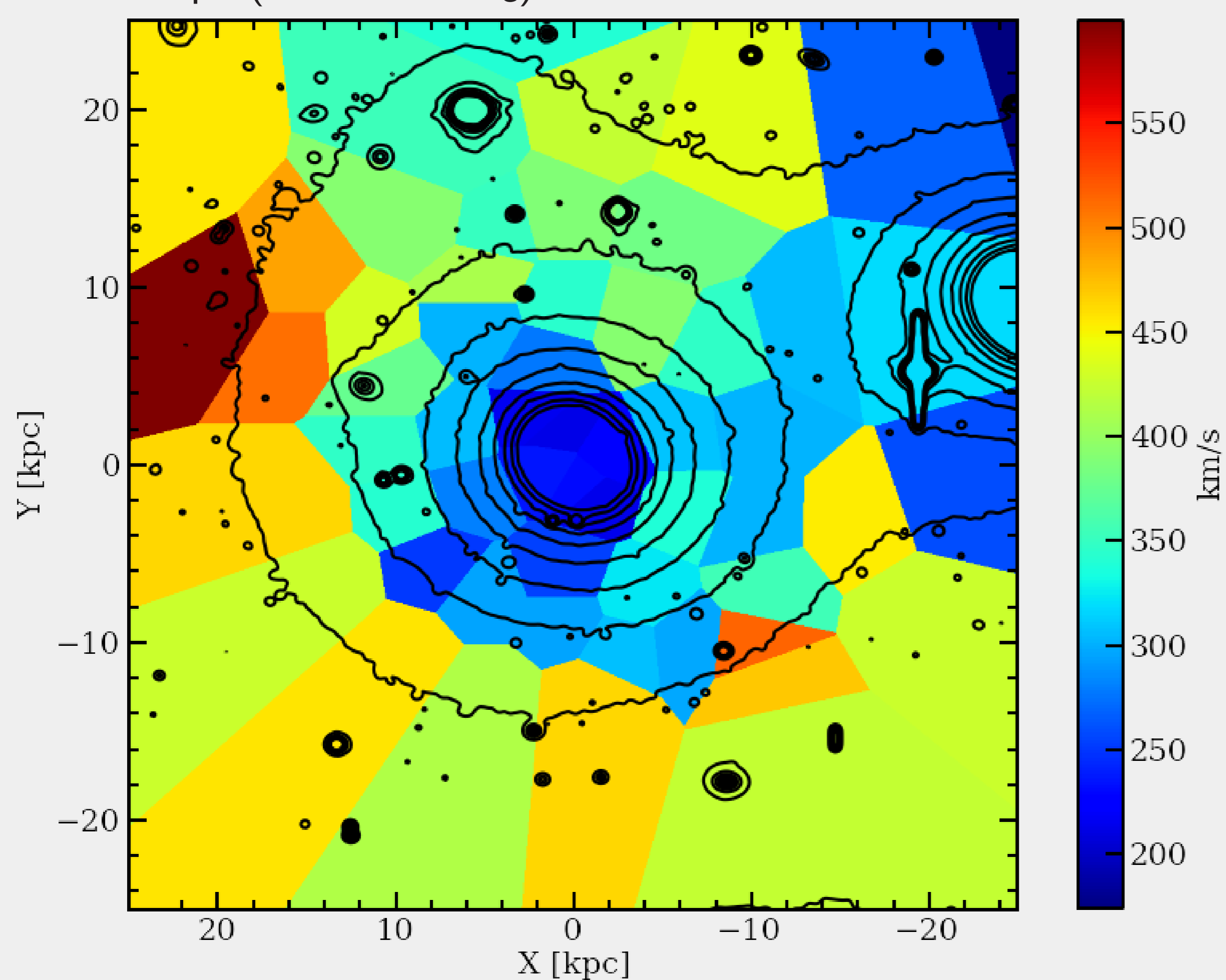


## Abstract

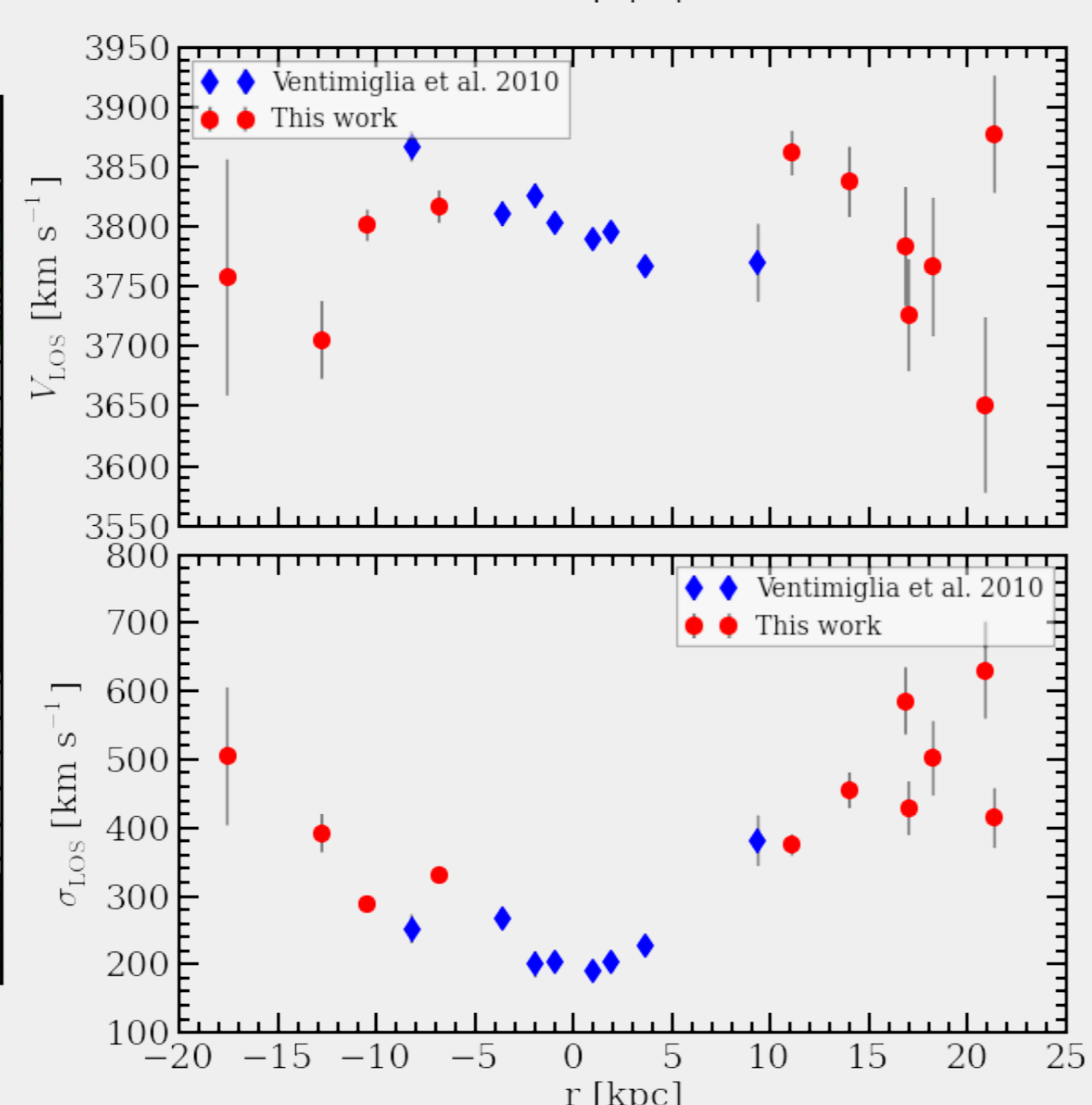
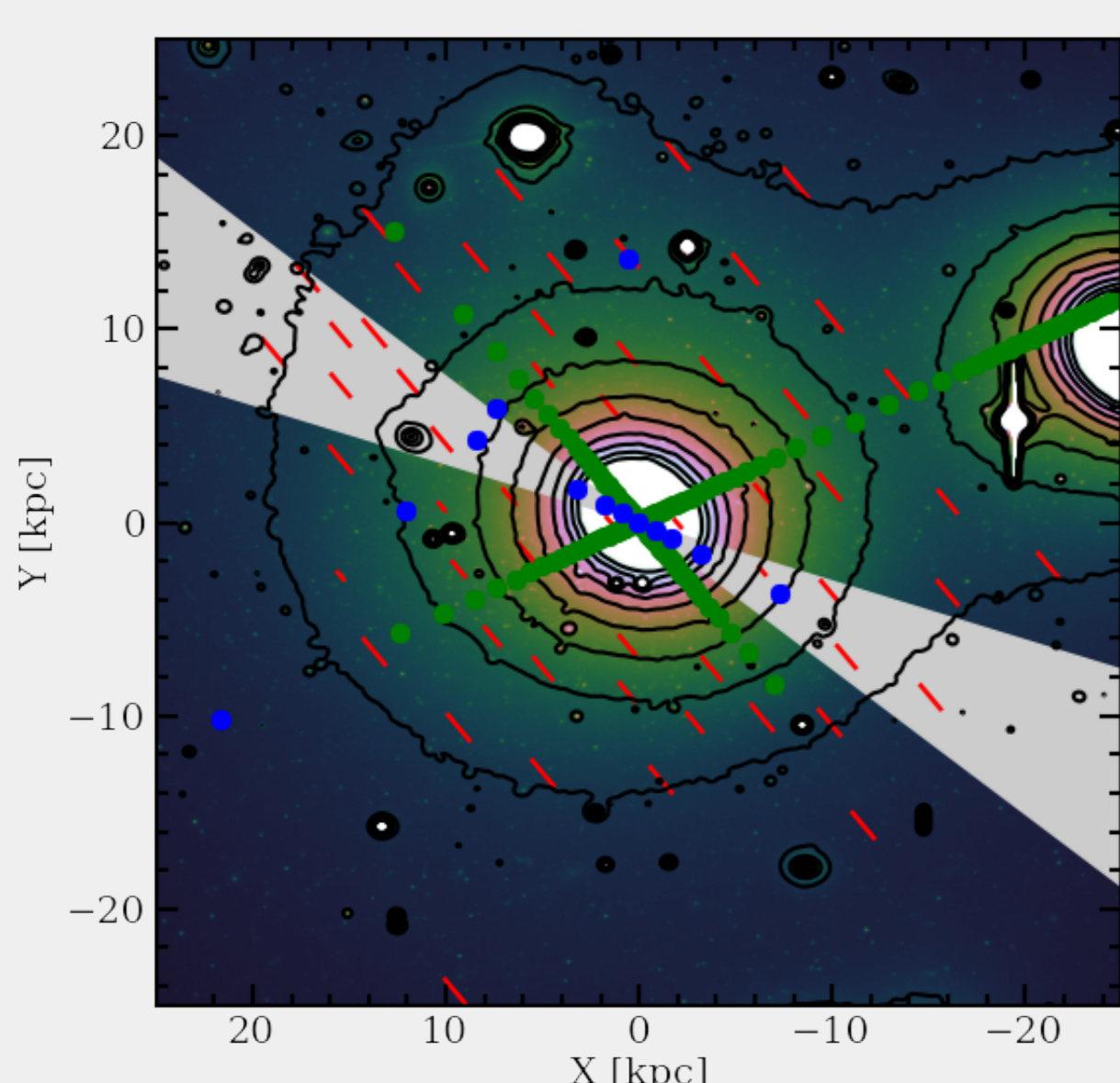
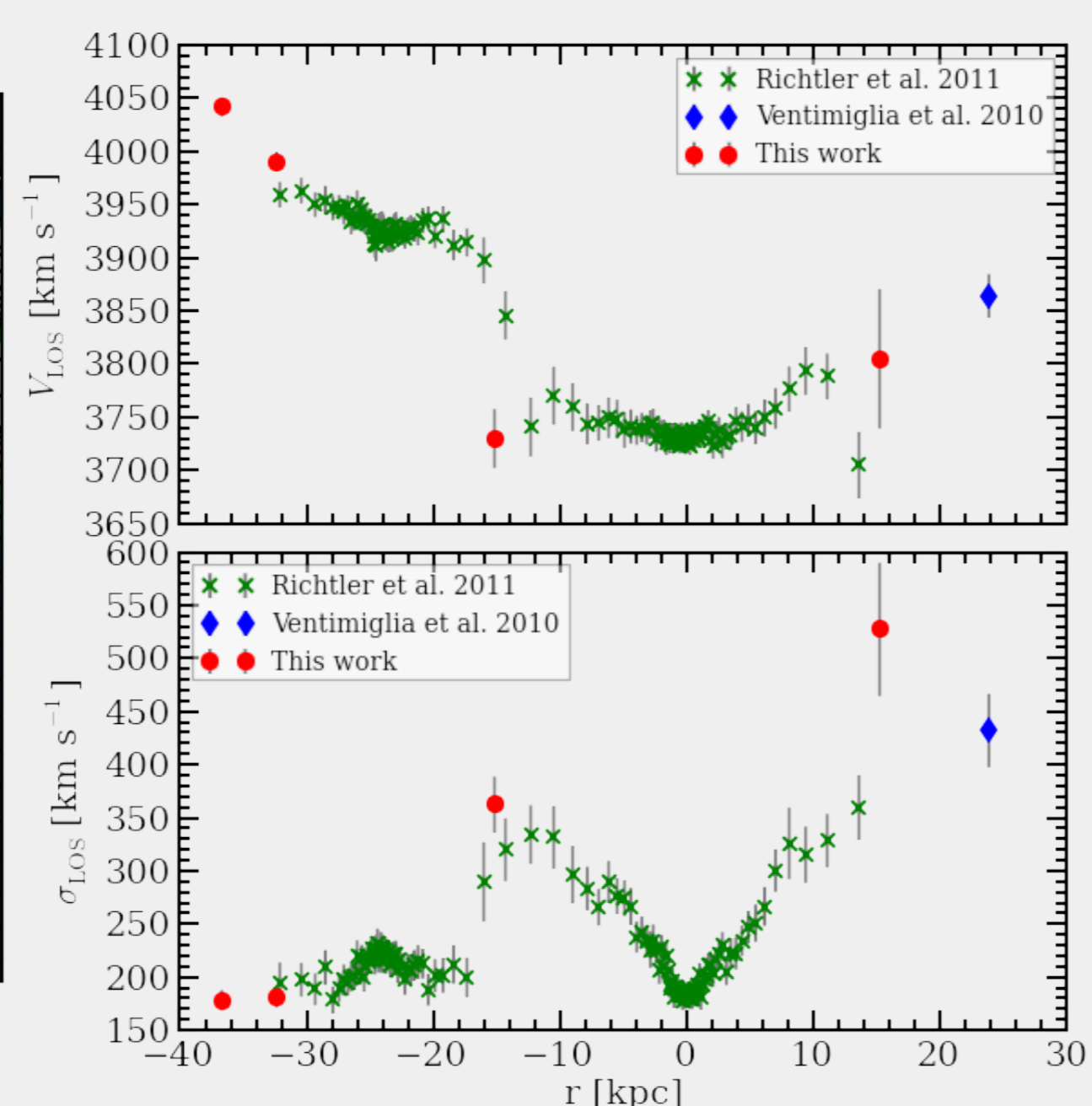
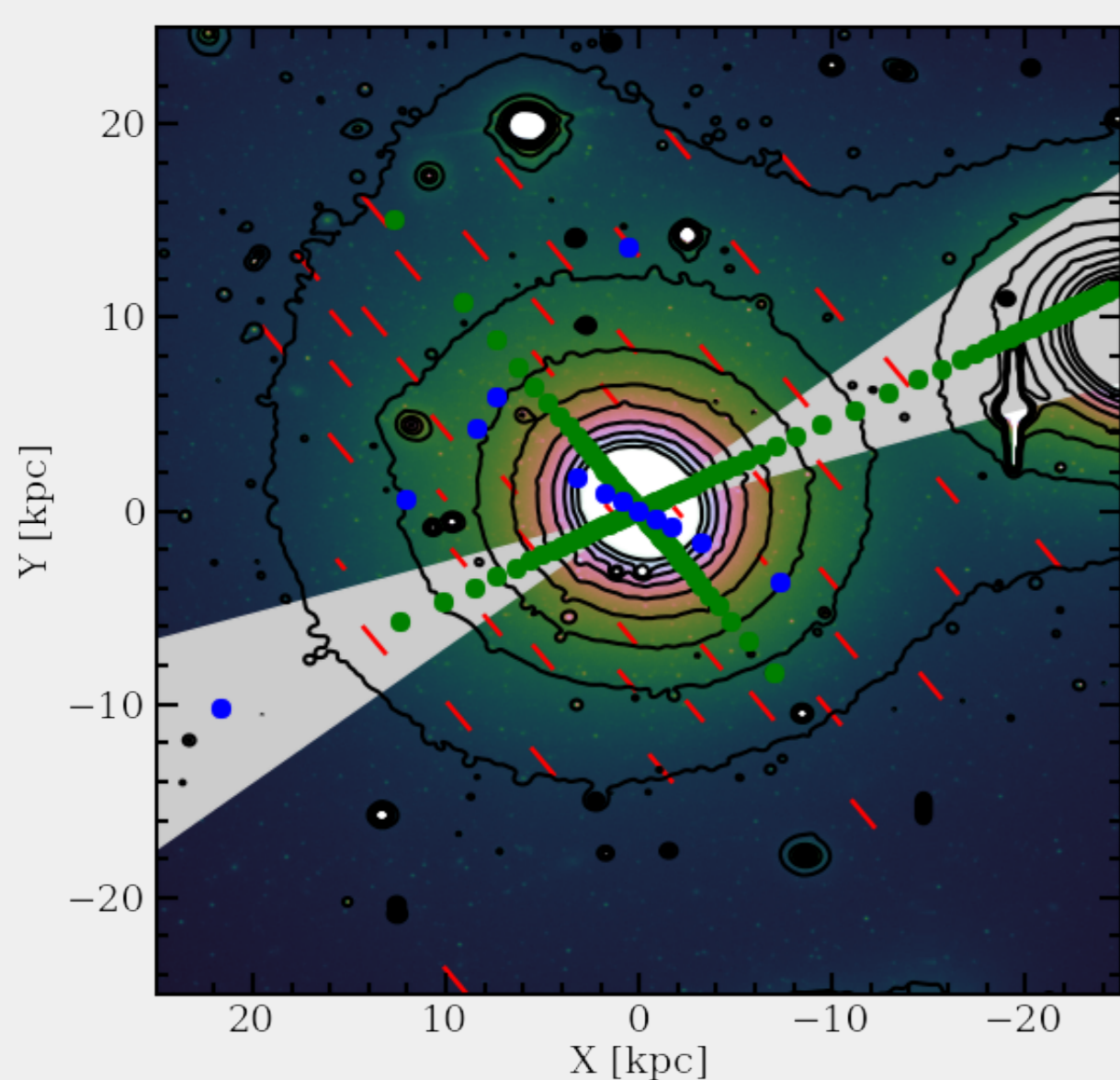
Halos of elliptical galaxies grow about four times since  $z=2$ , but there is no consensus of the main mechanisms responsible to expand these objects. Here we present the case of the core of the Hydra I, a local universe galaxy cluster with a cD galaxy NGC 3311. Using a novel set of observations from FORS2 at VLT, we present detailed maps of kinematics and stellar population of the central galaxy that confirms the unusual steep rise in the velocity dispersion, and the old and metal rich nature of NGC 3311, which appears to be formed in a two-phase process.

## Kinematics

- Data from FORS2@VLT with MXU mask technique. Slits are placed in an onion shell-like pattern around NGC 3311.
- The core of the Hydra I cluster presents a **steep rise in the velocity dispersion**, from  $\sigma \sim 180$  km/s in the central region to  $\sigma \sim 450$  km/s at  $R \sim 20$  kpc (around  $2.5R_e$ ).

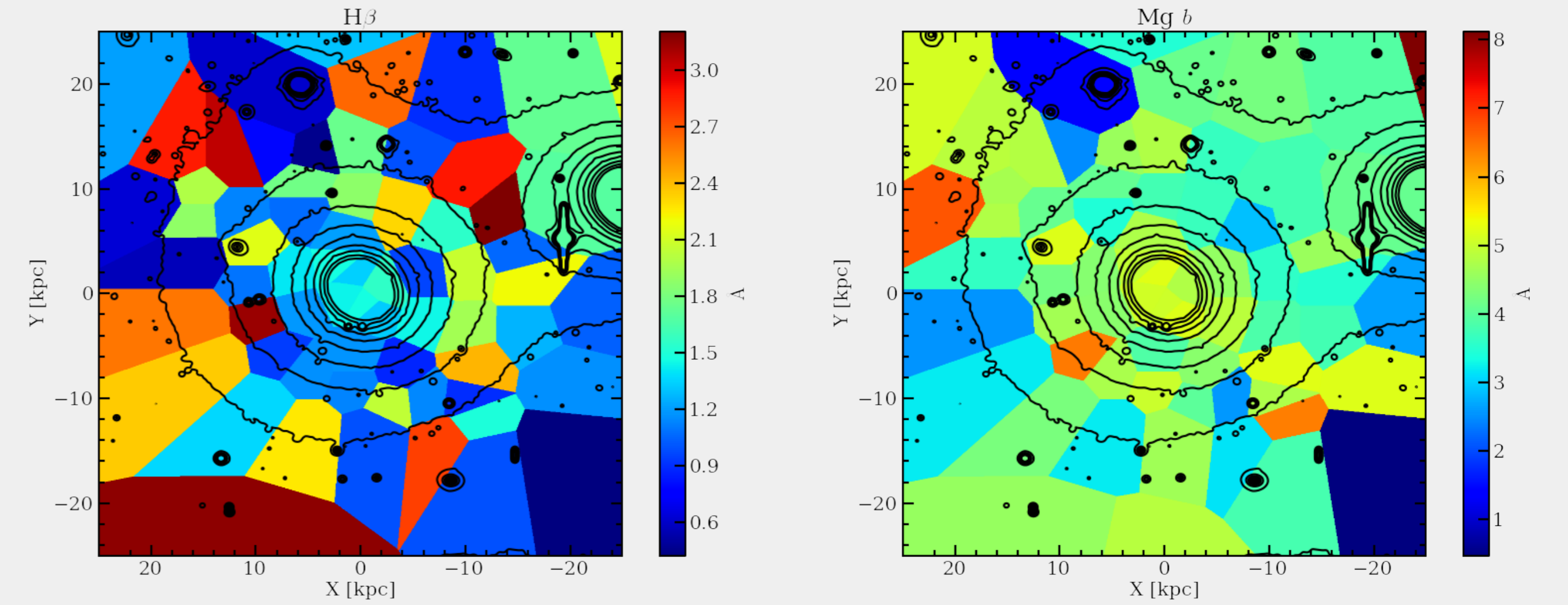


- The presence of a high velocity dispersion region in the NE region of the velocity dispersion image occurs at the same location of the photometric offset envelope seen in Arnaboldi et al. (2012) and of a dwarf galaxy being disrupted as it falls into the cluster core.
- Dispersion velocity profiles from (Ventimiglia et al., 2010) and Richtler et al. (2011) have shown differences of  $\sim 100$  km/s in the outer region of NGC 3311.
- **The azimuthal variation of the velocity dispersion profiles from our dataset explains naturally the differences between these previous measurements.**

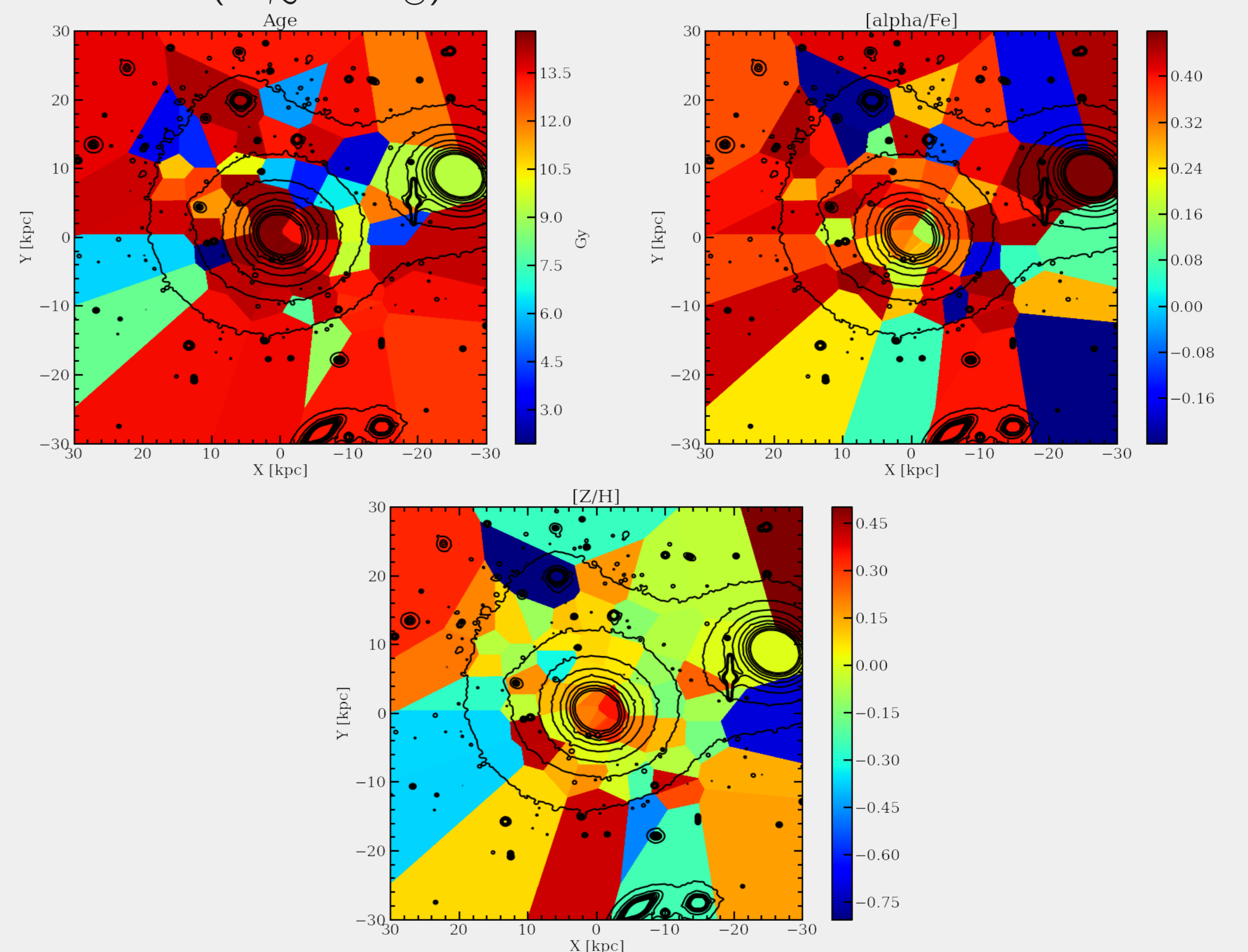


## Stellar population

- We measured the Lick indices for the absorption line spectra.



- We model these indices using the single stellar population models of Thomas, Maraston, & Johansson (2011).
- Our preliminary results indicate that the core of the Hydra I cluster has a **old stellar population** (Age  $\gtrsim 10$  Gyr) and **rich in  $\alpha$ -elements** ( $[\alpha/Fe] > [\alpha/Fe]_{\odot}$ ). Moreover, the central region of NGC 3311 is **metal rich** ( $Z \gtrsim 1.5Z_{\odot}$ ).



- While age and  $[\alpha/Fe]$  are relatively flat in the surveyed region, a **metallicity gradient of  $\Delta[Fe/H]/\Delta \log r \sim -0.3$**  for  $R < 2R_e$  is clearly distinguishable.

## Conclusion

- Our novel measurements on the kinematics of NGC 3311 has reconciled different results in the literature showing that the velocity dispersion profile of NGC 3311 varies at different position angles.
- These results point to the formation of NGC 3311 in a two-phase process – rapid assembly and dissipative collapse of gas at high redshift ( $z \gtrsim 2$ ), for the high central surface brightness region, and later accretion that lead to the formation of the outer halo.
- We plan to extend this analysis further in order to study the nature of the intracluster light, and devise a complete evolutionary scenario for the formation of the central region of the cluster.

## Acknowledgments

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## References

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