A catalogue of filaments in the SDSS with DisPerSE

Malavasi et al. 2020, ArXiv 2002.01486

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The creation of a catalogue of filaments in the SDSS with DisPerSE was motivated by the science goals of the works:

- **Bonjean et al. 2020, ArXiv 1912.06559**

We wanted to study **how filaments connect to a rich cluster (in our case Coma)** and to try to **derive their profile from the SZ signal and the galaxy distribution**.

We needed a catalogue of filaments in large volume of the Universe, derived from the galaxy distribution, as reliable and characterised as possible.
Discrete Persistent Structure Extractor (DisPerSE, Sousbie11, Sousbie+11)
Powerful algorithm, works with discrete density fields, no smoothing necessary.
Measure of the density field (e.g. DTFE)

Computation of the discrete gradient
Detection of critical points (maxima, minima, saddles)

Connection of critical points with filaments
Persistence cut to eliminate spurious structures due to noise
**The SDSS DR7 and DR12**

SDSS DR7 MGS (Strauss+02) and SDSS DR12 LOWZ+CMASS (Reid+16) ~$6 \times 10^5$ and $1 \times 10^6$ galaxies at $z = 0-0.3$ and $z = 0-0.8$

Volume density distribution: $n(z)$

Redshift distribution
The SDSS DR7 and DR12

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A CATALOGUE OF FILAMENTS IN THE SDSS
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**INTERESTING PROPERTIES**

Density distributions of critical points by type. Need for a topologically motivated algorithm to detect filaments, density threshold is not enough.

Length distribution of filaments.
The characterisation of the filaments includes:

- Effects of survey edges
- Defects (e.g. “isolated” maxima, 0-length filaments)
- Finger of God effect

Example: critical points at the edges
Quantifying the Effect of the Edges

Comparison of skeleton with and without points at the edges

Legacy MGS

LOWZ+CMASS
CHARACTERISATION: FoG

Quantifying the effect of FoGs

- Remove galaxies in cylinders around galaxy clusters
- Place a “fake galaxy” at the position of galaxy clusters with density equal to the removed galaxies in the cylinders
- Recompute the skeleton and compare
Quantifying the effect of FoGs

Comparison of skeleton with and without the inclusion of FoGs
EXAMPLE APPLICATION: THE LSS AROUND COMA

The Coma cluster is surrounded by other clusters and filaments. Can we find these structures with our filaments?
Hints of filament presence

Lyskova+19 X-ray

SB excess over beta-model

NGC4839
LIKE A SPIDER IN ITS WEB


Smooth: 1 - Persistence: 3σ

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ZOOM ON THE CLUSTER
The diagram highlights the cluster NGC4889/74 with the following features:

- **ICL** (Intermediate Stellar Content Layer)
- **X-ray shock**
- **To A2197/99**
- **To A1367**
- **NGC4839**

Key references:

- Filaments: Malavasi et al. 2020
- X-ray shock: Neumann et al. 2003
- Path of NGC4839: Lyskova et al. 2019
- ICL: Adami et al. 2005
CONCLUSIONS

BYOPIC PRESENTS:
THE COMA CLUSTER

LIKE A SPIDER IN ITS WEB
CONCLUSIONS

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