



## Different Wavelet-Based Approaches for the Separation of Noisy and Blurred Mixtures of Components. Application to Astrophysical Data

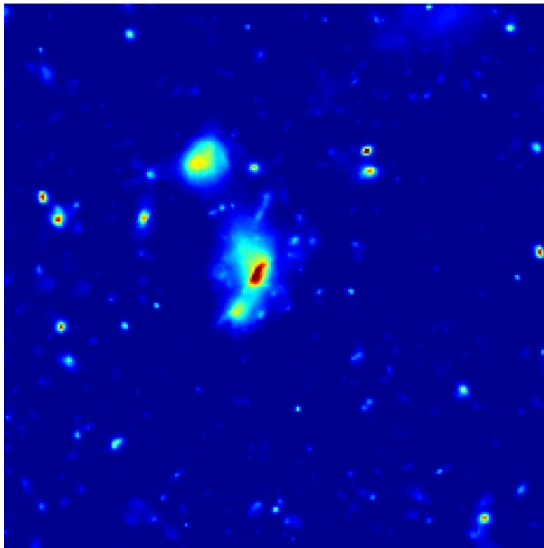
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### Sandrine F. Anthoine

My thesis addresses the problem of separating image components that have different structure, when different observations of blurred mixtures of these components are available. When only a single component is present and has to be extracted from a single observation, this reduces to the deblurring and denoising of one image, a problem well described in the image processing literature. On the other hand, the separation problem has been mainly studied in the simple case of linear mixtures (i.e. without blurring). In my work, the full problem is addressed globally, the separation being done simultaneously with the denoising and deblurring of the data at hand.



Clusters of galaxies.

I provided a mathematical analysis of a heuristic iterative algorithm for the enhancement of a single image; it turns out that it (unintentionally) blanks out certain particular features; I introduced a modification that does not suffer from this defect. I also developed and compared two methods for the multi-components/multi-observations problem. Both methods exploit the different structure of different image components and use wavelet decompositions to simplify the description of the data. The first method uses functional spaces to describe these signals; the second method models the local statistical properties of the signals. I evaluated the performance of both algorithms when applied to a particular astrophysical problem: the reconstruction of clusters of galaxies (see figure) by the extraction of their Sunyaev-Zel'dovich effect in multifrequency measurements of the Cosmic Microwave Background anisotropies. I have used realistic simulations, that correspond to different experiments, future or underway. I have shown that both methods yield clusters maps of sufficient quality for subsequent cosmological studies with observation of good quality and pointed out some limiting factors.