UV+IR mosaicking for study the extinction+emission of gas and dust clouds

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Abstract

The work with UV images presented in Armengot et al. (SEA XI 2014) allow the study of **extinction** through computer visual enhancing of these clouds. The composition with IR images of the same sky area introduces a new chance in the analysis of the features of these clouds (composition of gas and dust, temperature, size and shape). When the **UV** shadows are **overlapped** on the **IR emission** of dust grains from distant clouds, the main features of these clouds can be observed and measured. Here are our first experimental results applying these techniques in a data set of UV and IR files from the Taurus region. The results are compared with **theoretical models**. The software tools for enhancing and the **mosaic** programs availables are referenced as well.

Extinction cross section

From Mie theory:

$$Q_{EXT} = Q_{ABS} + Q_{SCA} \quad (1)$$

Emission and Extinction relationship

Dyson & Williams (1997)

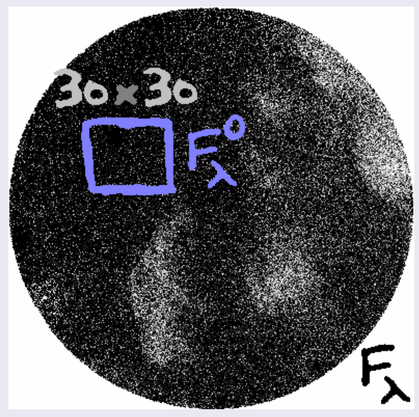
$$\int F(\lambda) Q_{ABS}(a,\lambda) d\lambda = \int Q_{ABS}(a,\lambda) B(\lambda, T_g) d\lambda \quad (2)$$

Extinction estimator

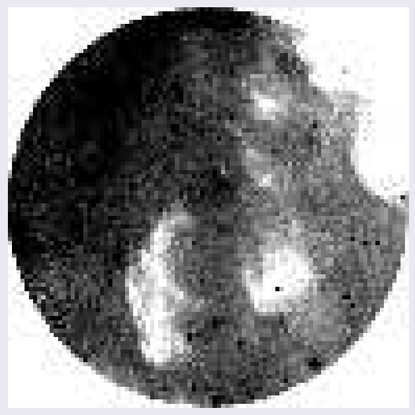
Draine (2003) ARAA

$$A_\lambda \approx 2.5\ log_{10}\left(\frac{F_\lambda^0}{F_\lambda}\right) \quad (3)$$

$A_{(\lambda=FUV)}$ estimation from GALEX signal (1)



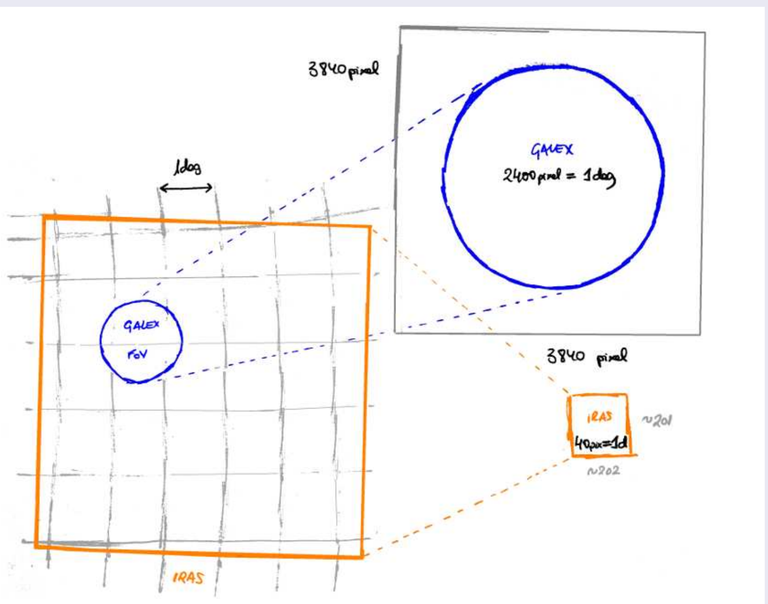
$A_{(\lambda=FUV)}$ estimation **128 × 128** map (2)



$A_{(\lambda=FUV)}$ estimation from GALEX signal (3)

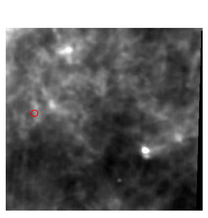
+ F_λ^0 flux in the absence of extinction (estimation)
+ F_λ observed flux

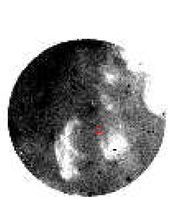
IRAS/GALEX scales

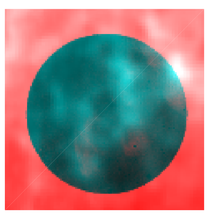


Multichannel **mosaicking** IR+UV

+ Mosaix from Armengot et al. (2014) As&SS
+ Traslation and rotation (same equations)
+ $IRAS \times 2 = 80$ pixels per degree **map**
+ $GALEX/30$ reduction in $A_{(\lambda=FUV)}$ estimation $= 80$ pixels per degree **map**
+ Reprojection with NASA **Montage** if needed

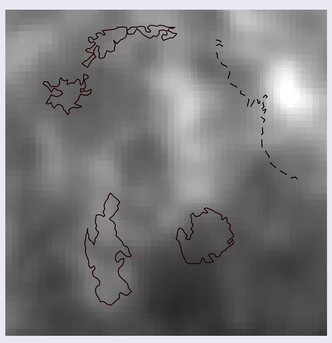






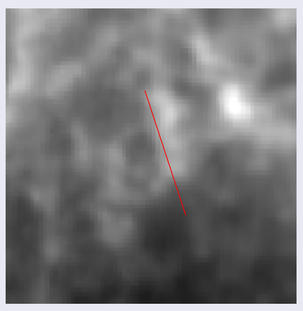
Overlapping map

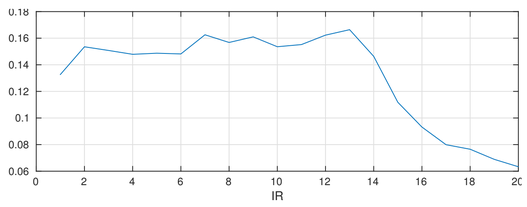
+ $A_{(\lambda=FUV)}$ estimation marked lines
+ IR channel on background

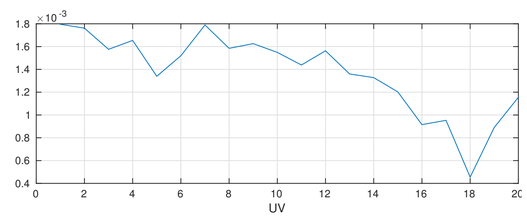


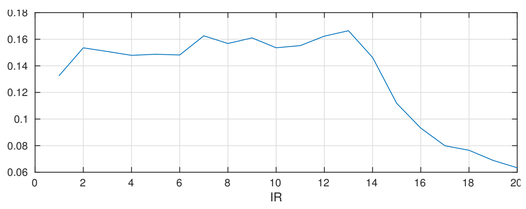
Rotation, translation, rescaling and $A_{(\lambda=FUV)}$ estimation ...

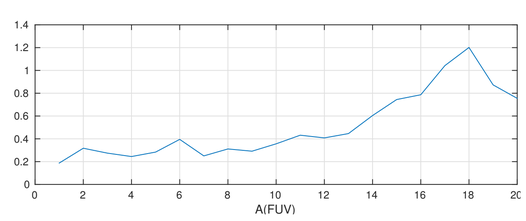
Data comparison (longitudinal line)



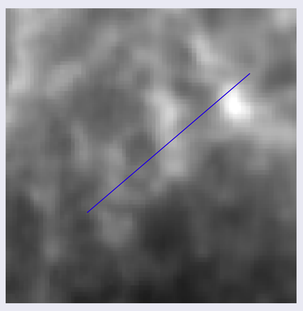


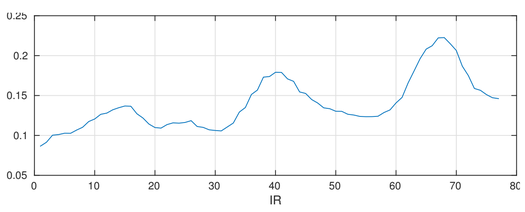


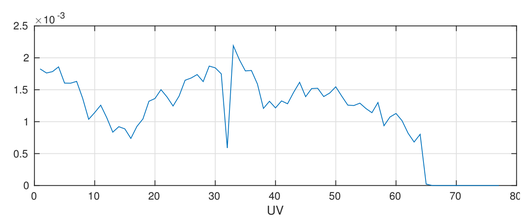


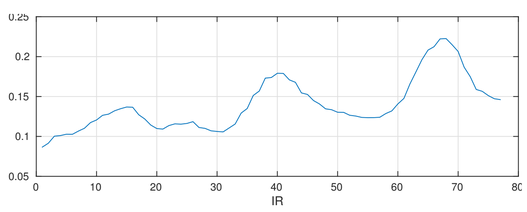


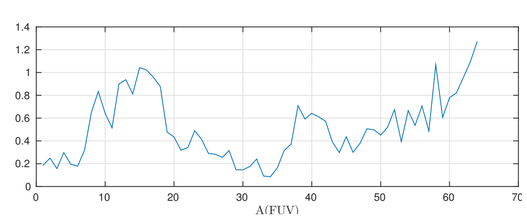
Data comparison (transverse line)







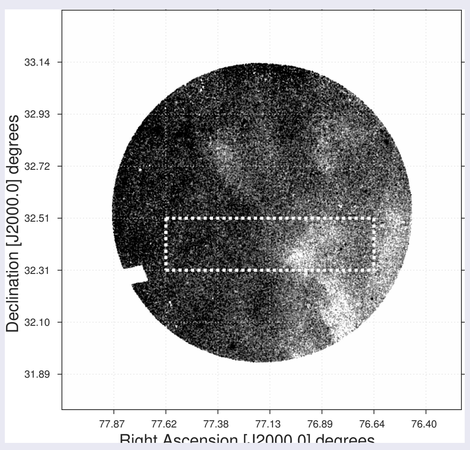


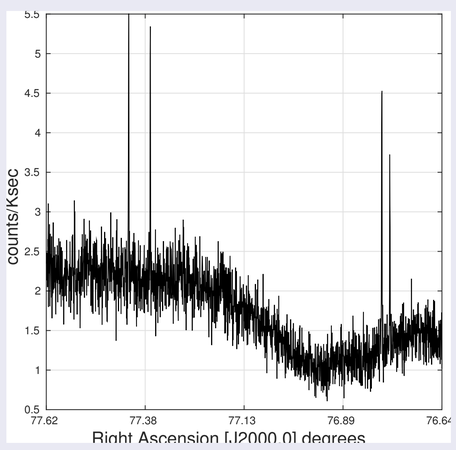


Some hypothesis

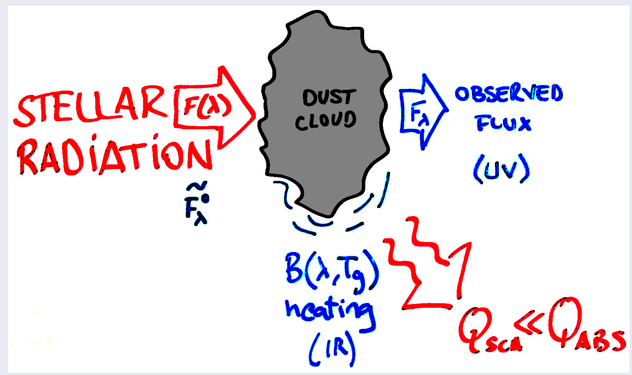
- *The left-hand side* (of the equation 2) *calculates the energy* **input** *into the grain from the radiation field in the visible and UV. The right-hand side calculates the energy* **emitted**, *and this range of wavelengths is generally in the infrared.* D&W (1997)
- Considering $Q_{EXT} = Q_{ABS} + \cancel{Q_{SCA}}$ the total extinction estimation $A_{(\lambda=FUV)}$ maps here presented could be an appropriate estimation of Q_{ABS} too.
- Divergences in previous plots are normal, the relationship between emission and extinction depends on several factors.
- Data sources in IR and $A_{(\lambda=FUV)}$ estimations could solve empirically the equation 2 for computing the size of a (radio of grain particles).

UV source signal





Scheme



Conclussions and work in progress

- IR and UV data together contribute to know more about gas and dust clouds.
- Processing more data from stellar formation areas is needed.
- Infrared cirrus and high-latitude molecular clouds in progress (Magnani et al. 1986 ApJ).
- $A_{(\lambda=FUV)}$ estimations and multichannel processed maps must be available.