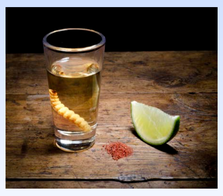
MEZCAL: ModElling high-Z Compact stArburst gaLaxies



(How well can we do it using local HII regions?)

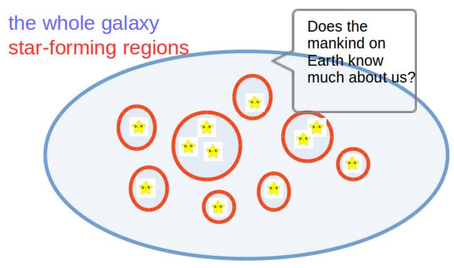
Tianxing Jiang (Arizona State Univ.), Patricio Lagos (IA Porto), Khadiga Mahmoud (AIP), Rene Ortega-Minakata (IA-UNAM), Ando Ratsimbazafy (NWU)

Introduction

The study of the HII regions as well as the diffused ionized gas helps us to understand the mechanisms that drive the star formation and galaxy evolution.

The general idea of our project is to model different HII regions and combine them to model a high redshift compact starburst galaxy. And the question is: how well can we do it using local HII regions? We chose two local well-known HII regions: Orion and 30 Doradus. We added a Blue Compact Dwarf (BCD) and a model of Diffuse Ionized Gas (DIG).

The aim is to build a composite model from those four models. Then, our goal is to work backwards, using CLOUDY to model the composite spectrum and obtain relevant parameters.



Model configurations

Table 1: The input parameters used to construct the models of each component in CLOUDY

Input parameters	Orion	30 Doradus	DIG	CTS 1020
SED	“Rubin.sed”	BB 5 3000 K	BB 30 000 K	BB 60 000K
Q(h)				53.85
Phi(h)	13.0		6.69	
Filling factor			0.25	
radius				21.58
Hden	4	2.3	-0.69	2
Turbulence			70	
U		-2.5		
Cosmic rays	✔	✔	✔	✔
CMB	✔		✔	✔
abundance		ISM	ISM	
dust	Orion	grains		
metallicity	-0.17	-0.39		-0.44

Fig.1: Left image: Orion nebula. Middle image: 30 Doradus. Credit from HST. Right image: Hβ image of CTS 1020 (Lagos et al. 2007)

Results

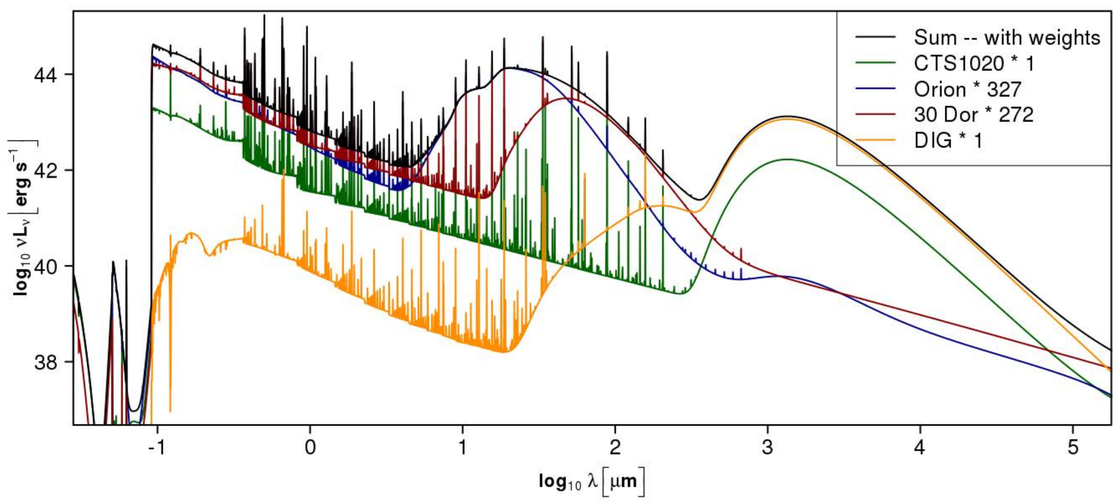


Fig. 2: This figure illustrates the SED of the four modelled HII regions weighted by the expected number of each type according to their size distribution in a galaxy (Russeau-Nepton et al. 2017, Fig. 21), and the combined, weighted SED model (Sum).

Parameters	CTS 1020	Orion	30 Doradus	DIG	Composite spectrum
Te (K)	10 795	8 783	10 945	6 154	10 309
Ne (cm^{-3})	97	4 369	210	2	217
12+log(O/H)	8.19	8.39	8.07	7.77	8.15
U	-2.90	-1.48	-2.50	-3.08	-2.61

Table 2: This table shows the physical properties of the four components and the composite spectrum. After running CLOUDY using the properties of the composite and by varying the parameters Te and U, we obtained an optimized value of the ionization parameter U of -2.61

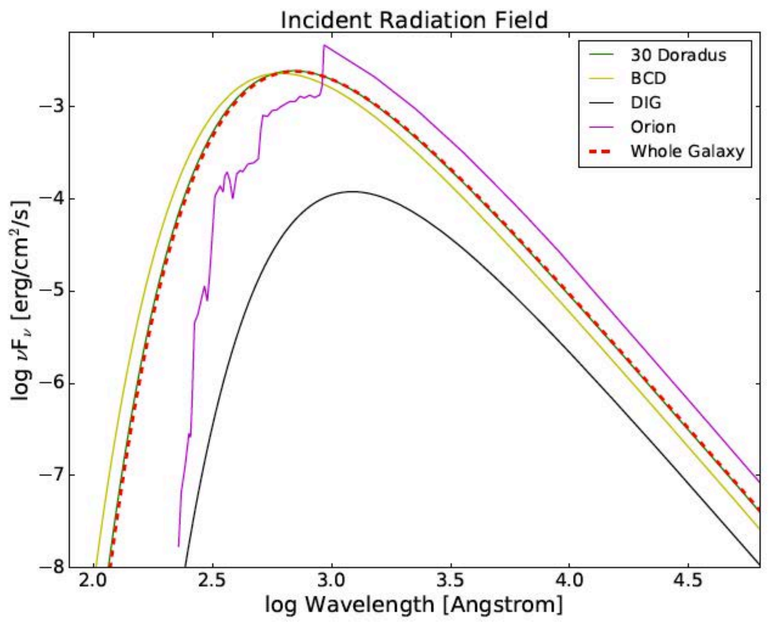


Fig. 3: This figure illustrates the shape of the radiation field for the four components and the shape of the inferred blackbody incident radiation field of the whole galaxy from CLOUDY.

Conclusions

- We found that the model of our composite spectrum has properties corresponding to intermediate properties of the component models.

References

Russeau-Nepton et al. (MNRAS submitted), arXiv: 1704.05121
Lagos et al. (2007), A & A, 476, 89