RevMexAA (Serie de Conferencias), **49**, 125–125 (2017)

ORIGIN OF THE STARBURST PHENOMENON AS IMPLIED BY STRONG STAR FORMATION EVENTS IN DWARF GALAXIES

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We report on evidence that the highest specific star formation rate (SSFR) in dwarf galaxies in the local Universe is achieved while they pass the same stage of their chemical evolution corresponding to metallicity of $\sim$1/3 $Z_\odot$. It is supported by the observation that a strong star-burst event had occurred in early spheroids at the virtually same metallicity, imprinted in the peak metallicity of the sub-populations of metal-rich globular clusters (MRGCs).

Analyzing a variety of data published to date, Kravtsov (2006) showed, for the first time, that the formation of both young/intermediate-age massive star cluster populations in nearby dwarf galaxies and the populations of metal-rich globular clusters in spheroids occurred at virtually the same stage of the hosts' chemical evolution, around $\sim$1/3 $Z_\odot$. It was achieved very early in (massive) spheroids and much later in dwarf irregular galaxies, depending on their mass. This conclusion relied on a limited sample of nearby dwarf galaxies currently experiencing or, like the LMC, experienced some time ago a strong large-scale star-burst accompanied with formation of massive star clusters. This implied that maximum star-formation activity, expressed in SSFR, in dwarf (irregular) galaxies should be observed near $\sim$1/3 $Z_\odot$, while they are reaching the given particular metallicity in their chemical evolution.

To check the validity of this assumption, we summarized our analysis of different results/datasets obtained independently on strong star-burst activity in large samples of star-forming galaxies. We first refer to the data of Mallery et al. (2007) on a sample of more than 8700 *GALEX* emission-line star-forming galaxies falling in metallicity range $8.0 \lesssim 12 + \log(O/H) \lesssim 9.0$, in the local Universe. Fig.2 of the work plots $\log(N/O)$ vs. $12 + \log(O/H)$ and shows also SSFR, $\log(SFR/M_\star)$, as a color parameter. It is an impressive indication that the SSFR in the galaxies of this huge sample increases, on average, with decreasing metallicity and achieves its maximum value near the low-metallicity end of the range. The same authors isolated and listed in their Table 2 a sample of 33 galaxies having at least a 3 σ detection of [OIII] λ4363 line that is known to be stronger in young and strong star-bursts (Perez et al. 2016). For these galaxies, Mallery et al. (2007) made direct reliable estimates of the oxygen abundance via the T_e method, SSFR, and stellar masses, $M_\star$, etc. Their means and standard deviations are: $12 + \overline{\log(O/H)} = 8.24$ ($\sigma = 0.09$); $\overline{\log(SFR/M_\star)} = -8.69$ ($\sigma = 0.37$); $\overline{\log(M_\star)} = 9.08$ ($\sigma = 0.56$). The oxygen abundance is around 1/3 of the solar value (Asplund et al. 2009). Izotov et al. (2011) isolated a sample of more than 800 *luminous compact galaxies* and measured oxygen abundance in these via the direct T_e method, as well. The authors obtained $12+\overline{\log(O/H)} = 8.11$ and $\overline{M_\star} = 1.07\times10^9 M_\odot$ (i.e. $\overline{\log(M_\star)} = 9.03$). This value of the mean stellar mass and the mean SFR of 4 $M_\odot yr^{-1}$ result in $\overline{\log(SFR/M_\star)} = -8.43$. The typical (mean or median) values of $12 + \log(O/H)$ and of the other two parameters, $M_\star$ and $\log(SFR/M_\star)$, are indistinguishable in the two studies. Finally, Cardamone et al (2009) reported on and studied a sample of 80 "green pea" galaxies. The majority (66 unites) of these luminous compact galaxies are in common with those studied by Izotov et al. (2011) and have the same mean oxygen abundance ($\sim$1/3 $Z_\odot$) in the metallicity scale defined by the direct T_e method. We conclude that the presented results do not support the point of view that any major star burst in galaxies is an accidental, externally induced process.

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XV Latin American Regional IAU Meeting (Cartagena de Indias, Colombia, 3-7 October 2016)
Editors: Mario Armando Higuera Garzón & Santiago Vargas Domínguez