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EVN OBSERVATIONS: UNVEILING THE HEART OF LIRGS AND ULIRGS

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RESUMEN

Con la alta sensibilidad y resolución que brindan instrumentos como el "European Very Long Baseline Interferometry Network" (EVN), es posible estudiar las regiones nucleares y circunnucleares de galaxias luminosas ($L_{\rm FIR} > 10^{11}\ L_{\odot}$) y ultraluminosas ($L_{\rm FIR} > 10^{12}\ L_{\odot}$) en el infrarrojo (LIRGs y ULIRGs, respectivamente), en las que las altas tasas de formación estelar (SFR) garantizan la aparición de radio supernovas (RSNe) brillantes. En este trabajo presentamos algunos resultados recientes de nuestra campaña de observaciones con el EVN hacia el sistema de galaxias en interacción Arp 299, y hacia una de las ULIRGs más lejanas y luminosas del Universo local, IRAS 23365+3604.

ABSTRACT

With the very high sensitivity and resolution provided by instruments such as the European Very Long Baseline Interferometry Network (EVN), it is possible to study the nuclear and circumnuclear regions in Luminous ($L_{\rm FIR} > 10^{11}\ L_{\odot}$) and Ultraluminous ($L_{\rm FIR} > 10^{12}\ L_{\odot}$) Infrared Galaxies, where the high Star Formation Rates (SFR) guarantee the occurrence of bright Radio Supernovae (RSNe). In this work we present some recent results from our EVN campaign of observations towards the interacting system Arp 299, and one of the brightest and farthest ULIRGs in the local Universe, IRAS 23365+3604.

Key Words: galaxies: individual (IRAS 23365+3604, Arp 299) — galaxies: starburst — supernovae: general

1. INTRODUCTION

Luminous Infrared Galaxies with $L_{\rm FIR} > 10^{11}\ L_{\odot}$ (named LIRGs) and $L_{\rm FIR} > 10^{12}\ L_{\odot}$ (named ULIRGs) are very interesting objects thought to represent an important stage in the formation of Quasars (QSO) and powerful radio galaxies (Sanders & Mirabel 1996). Most of them seem to be the products of Galaxy-Galaxy interactions, mergers or bar instabilities, i.e., when no recent merger activity is found (see e.g., the contribution on isolated LIRGs from Fuentes-Carrera et al. 2011). Low redshift LIRGs are rare, but at $z \sim 1$ (Le Floc'h et al. 2005) are found to dominate the IR background, as well as the SFR density. The same is true for ULIRGs, but at $z \sim 2$ (Caputi et al. 2007).

(U)LIRGs exhibit two main facets. These galaxies radiate most of their energy in the FIR (40–500 μm) and display quasar-like luminosities. Nevertheless, (U)LIRGs also have FIR, mm, and radio characteristics which resemble those of star-forming galaxies (see e.g., Soifer et al. 1987; Sanders & Mirabel 1996). Very important questions arise: What is powering these galaxies? What mechanism is responsible for the heating of the large reservoirs of gas and dust contained in the inner kpc region of these systems? Is it an Active Galactic Nucleus (AGN) and/or a starburst (SB)? To answer these questions we have to observe deep in the "hearts" of these galaxies.

The knowledge retrieved from other studies is our point of departure. For example, Condon (1992) has shown that the RSN rate is proportional to the SFR, and these two scale with $L_{\rm FIR}$. According to this relation, we have that high SFR ensures high Core Collapse SN (CCSN) rates, which for (U)LIRGs, turns out to be at least one or two orders of magnitude larger than in normal galaxies such as the Milky Way.

CCSN counts will help to constrain the IMF of massive stars and give estimates of the SFR in a given galaxy. We should use instruments which provide high-angular resolution and sensitivity in order to detect CCSNe which are embedded in very dusty environments and thus subject to high extinction. The technique called Very Long Baseline Interferometry (VLBI) fulfils our requirements. In particular, we have used the European VLBI Network (EVN).

2. OUR PROJECTS

In this section we show some recent results from our EVN observations toward two sources we have been monitoring. We want to remind the reader at this point, the importance of performing observa-

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