The puzzling nature of RHRS1

Laure Ciesla,
Herschel Reference Survey, \( \sim 300^\circ \)}
Evidences for a strong lensing case

The extreme $L_{\text{IR}}$

$L_{\text{IR}} \sim 9 \times 10^{13} \, L_{\text{Sol}}$

peaks at 500 microns: 123 +/- 11 mJy
Evidences for a strong lensing case

The morphology of the system

The IR emission splits in 3 radio sources disposed on an "arc"
Evidences for a strong lensing case

The morphology of the system

CFHT/i

UKIDSS/K

IRAC1

Optical counterpart at the center of the 3 VLA blobs:

- complex morphology
- possibly @ z~1-2
Evidences for a strong lensing case

$L'_{\text{CO}(1-0)}$ – linewidth relation

$L'_{\text{CO}} - L_{\text{IR}}$ \xrightarrow{\text{Sargent+14, assuming the same linewidth than CO(5-4)}}$

$L'_{\text{CO}(1-0)}$ – linewidth typical of lensed galaxies

Harris+11
Evidences for a strong lensing case

To summarize

Lens

Background source

z~1-2

CFHT, WHT, UKIDSS, IRAC, Xshooter

VLA 3GHz

z=4.72

Herschel/SPIRE, NIKAI, VLA, IRAM/EMIR, IRAM/NOEMA
Modelling the strong lensing configuration

One Single Isothermal Elliptical mass distribution

- Good position of the modeled blobs
- Good flux ratios between the modeled blobs

\( R_{\text{Einstein}} \approx 2.2'' \)

<table>
<thead>
<tr>
<th>( z )</th>
<th>( M_\star \left( M_\odot \right) )</th>
<th>( M_{DM} \left( M_\odot \right) )</th>
<th>( r_{\text{Einstein}} \left( \text{kpc} \right) )</th>
<th>( M_{DM} / M_\star )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>( 4.47 \times 10^{10} )</td>
<td>( 2.34 \times 10^{12} )</td>
<td>13.5</td>
<td>52.3</td>
</tr>
<tr>
<td>1.0</td>
<td>( 3.07 \times 10^{11} )</td>
<td>( 4.43 \times 10^{12} )</td>
<td>18.5</td>
<td>14.4</td>
</tr>
<tr>
<td>1.5</td>
<td>( 5.92 \times 10^{11} )</td>
<td>( 6.08 \times 10^{12} )</td>
<td>19.5</td>
<td>10.3</td>
</tr>
<tr>
<td>2.0</td>
<td>( 8.17 \times 10^{11} )</td>
<td>( 7.35 \times 10^{12} )</td>
<td>18.5</td>
<td>9.0</td>
</tr>
</tbody>
</table>
If lensed: the consequences
And if not lensed?

10,000 M$_{\text{sol}}$/yr within 20kpc at z=4.72!

Extreme protocluster?
And if not lensed?

$z_{\text{spec}} = 4.0$

$L_{\text{IR}} = 3.7 \times 10^{13} L_{\text{sol}}$

11 sources over 300 x 300 kpc
Solving the problem...

Proper reduction of Xshooter data expected in December

IRAM/NOEMA PI: L. Ciesla
Ranked A; Winter Semester

CO detection of each VLA blob resolved 1mm continuum

redshift of the optical/NIR emission

Are the blobs the same image of one source or 3 different galaxies?
Archive of spectro-photometric galaxy surveys

Upload your data safe and private!

Receive your results + quality tests + report

+ added-values from GAzPAR