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TYPHOON observations of the Lindsay-Shapley Ring

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Abstract. We present the first results of the TYPHOON program on the ring galaxy AM 0644-741. TYPHOON is a program for producing highly resolved spectrophotometric data cubes with wavelength coverage ranging from [OII] 3727A to 7000A. Using the first results of TYPHOON we will show its efficacy in producing images and from that we will create velocity maps, one of the many uses of TYPHOON results. From this program we will deduce the motion of gas in the ring structure of AM 0644-741 to better understand how the galaxy has evolved to its present state.

Keywords. galaxies: kinematics and dynamics, galaxies: interactions, surveys, techniques: spectroscopic

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TYPHOON is a newly developed methodology for producing highly resolved spectrophotometric data cubes using conventional spectrographic capabilities. Using TYPHOON, we are currently undertaking a survey of 100 of the closest and largest southern-hemisphere galaxies visible from the Las Campanas Observatory in Chile where observations are made on the 2.5m du Pont telescope. TYPHOON has a spectral range from 3727 to 7000 Angstroms, 3-6 Angstrom spectral resolution, and a spatial resolution that is seeing-limited at less than one arcsecond. Our program using TYPHOON has many far reaching scientific goals, but for the first foray into data analysis, we have chosen to explore its ability to study kinematic structure.

Here we show the results of our kinematic structure study of the Lindsay-Shapley Ring, also known as AM 0644-741. AM 0644-741, a classic collisional ring galaxy, is easily observed from the southern hemisphere, large and bright at redshift 0.022029 (Fisher *et al.* 1995) , and is a good candidate for TYPHOON. We have extracted those channels at and around the doppler-shifted wavelength of Hα for AM 0644-741, as shown in (Fig. 1). This image was created by imposing a narrow-band "filter" on the data to collect and collapse the doppler-shifted emission from the ring. Using the multi-dimensional capabilities of the data cube, the greyscaled velocity moment map of AM 0644-741 is shown in (Fig. 2).

The kinematic structure of AM 0644-741 has been previously studied, but not with the spectral resolution or areal completeness as with TYPHOON (e.g., Few *et al.* 1982, Higdon & Wallin 1997). As can be seen in Fig. 2, there is obvious rotation of AM 0644-741 progressing from the southwest to the northeast directions. The ring is seen rotating from -550 to 350 km/s giving a peak-to-peak velocity range of 900 km/s. Given the velocity resolution of TYPHOON, we can additionally see that the velocity changes from the inner to the outer edges of the ring on the order of 200-300 km/s depending on the position in the ring. We also note the asymmetry of the ring in velocity space. This is

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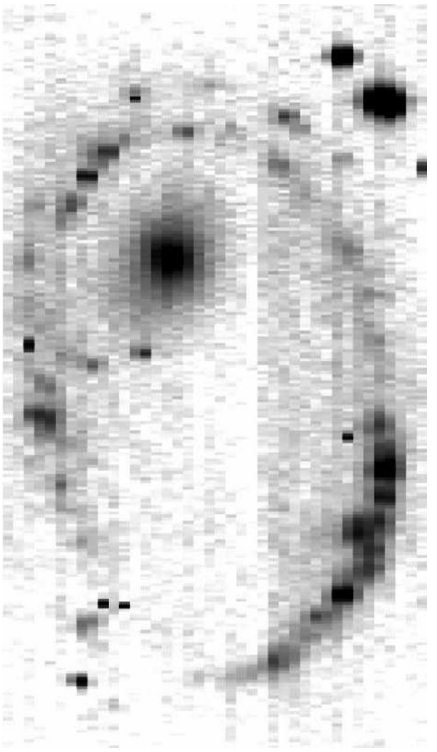

Figure 1. Data extracted from around the doppler shifted Hα to create a narrow band "filter" image of AM 0644-741.

reasonable due to the projection effects of a combined rotation and expansion of the ring, as noted by other studies (e.g., Few *et al.* 1982).

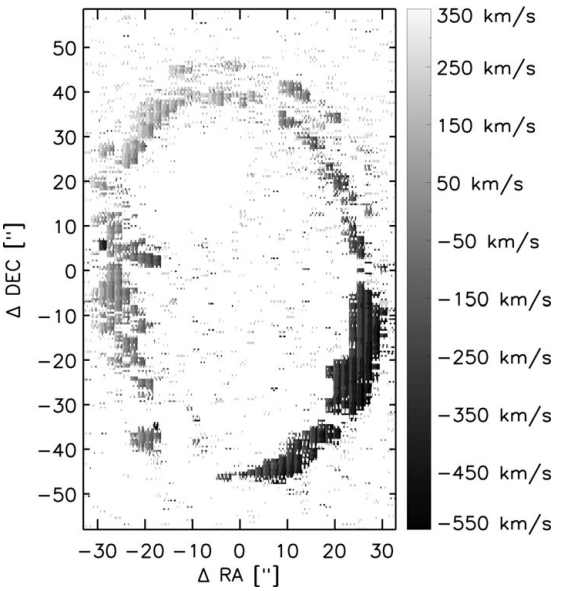

Figure 2. Greyscaled velocity moment map of AM 0644-741.

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Future work on the Lindsay-Shapley Ring Galaxy using TYPHOON will be to better understand the origin of the galaxy's current kinematic and spatial structure. We will be modeling the collision and adjusting the initial parameters and masses of AM 0644-741 and the impacting galaxy to replicate our results. From there, we can deproject the ring, due to its angle on the plane of the sky, by comparing it to the model and thereby separately determine the rotation and expansion rates of the ring material. We should be able to accurately age date this collision event and place reasonable constraints on the many collision input parameters.

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