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Radiation hydrodynamical simulations of the later phase of a merger-burst ILOT

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ABSTRACT
We simulate the later evolution of a merger-burst transient, consists of a massive thick accretion disc around a main sequence star. The accretion disc is the result of probably a $1\mathrm{M}_{\odot}$ object on the verge of the main sequence distraction onto a $8\mathrm{M}_{\odot}$ star. This setup emulate the properties of the prototype Luminous Red Nova, V838 Mon. We find that XXXXMsun is accreted onto the star, and calculate the expected lightcurve. We find XXXXXXXXX

Key words: accretion, accretion discs — (stars:) binaries: general

1 INTRODUCTION

V838 Mon is a well observed outburst first discovered January 2002 (Brown et al. 2002) to April 2002 (Tylenda 2005). It also include earlier time pregenerator (Tylenda et al. 2005) and later time light echo observations (for example Kamiński et al. 2018). V838 Mon object is classified as luminous red nova and the leading model is of stellar merger (Tylenda & Soker 2006; Kochanek et al. 2014; Kamiński et al. 2015; Smith et al. 2016; Kamiński et al. 2018). Luminous Red Nova (LRN) or more accurate intermediate luminous red transient is a class of Intermediate Luminous Optical Transients (ILOTs; recently also refereed to as "Sokers", Kashi & Soker 2016).

LRN or Merger Bursts refer to quite diverse group of objects describing transients powered by a complete merger of two stars. The denser star is tidally destroys the less dense star and accretes most of its mass. This releases gravitational energy that powers the event. Some mass from the destroyed star escapes the system. This presents a characteristic merger light curve. More object in this class are V1309 Sco (Tylenda et al. 2011), and possibly eruptions of somewhat more massive progenitors, NGC 4490-OT (Smith et al. 2016) and M101 OT2015-1 (Blagorodnova et al. 2017) as well as the small young stellar object ASASSN-13db (Kashi et al. 2019).

The light curve declines by XXXX mag in XXXX days in the V-band. SOKERYTLENDA calculated the bolometric light curve using a model XXXXXXTELL ABOUT IT. They found that the peak luminosity is XXXX, and the total energy in the eruption is XXXXX. XXXXX BOND? observed typical line velocities of XXXXkm/s. More obs.XXXX

If we use V838 Mon as the prototype of its class od light curves, we see that the rise time scale is in the order of days and can have more then one stage. We expect to have more than one peak. The decline stage is very steep, occasionally with local peaks along the decline (Crause et al. 2003, 2005). Tylenda & Soker (2006) argued that this behaviour best fits by gravitational dominated process. Kashi et al. (2010) showed that V838 Mon and many other transients have similar shapes of their light curves when scaling the time axis. Moreover, these authors suggested to classify transients by estimating the total energy of each event (radiation + kinetic energy) rather than by the peak of its light curve. The Energy-Time Diagram (ETD) is used for that purpose (Kashi & Soker 2016, 2017) [1]. In the EDT many of the transients form a slated stripe more energetic than novae yet less energetic than SNe, referred to as the Optical Transient Stripe (OTS).

CITE XXXX SOKER TYLENDA suggested a model a model for the observation of LRNe is stellar merger see .... The merger in this system a massive star with a regular star where the accreted star is less dens probably a YSO with thick accretion disk. The probably result in massive star with thick disk see...

describe creation of thick disk (cooling time and viscosity longer the Keplerian and dynamic time) from frank power accretion (FKR) Tidal disruption radius and time (Rees 1988).

In this paper we model the system as merger resulting thick accretion disk around massive star. We focus on the accretion process and resulting observational signature expected (light curve) from such system. and discuss V838 Mon observation in light of this analysis.

XXXX velocity of matter eject ot of the photosphere of the disk relative to observations (and spectrums). XXXX more quotes and description specific to V838 Mon

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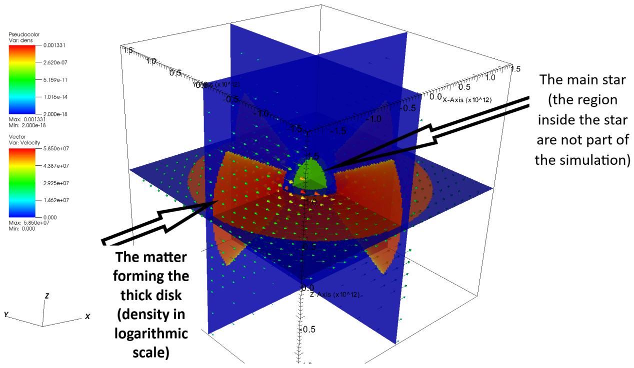
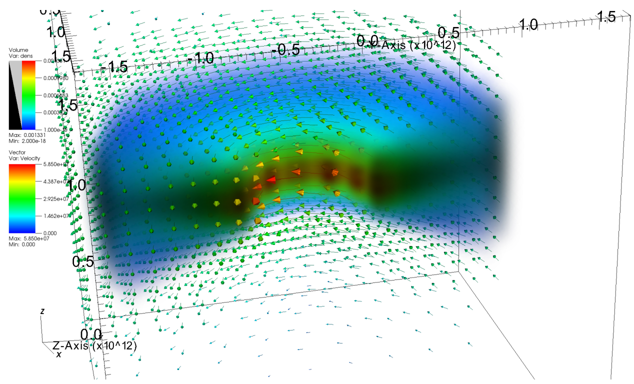
[1] For an up-to-date ETD figure see `phsites.technion.ac.il/soker/ilot-club/`

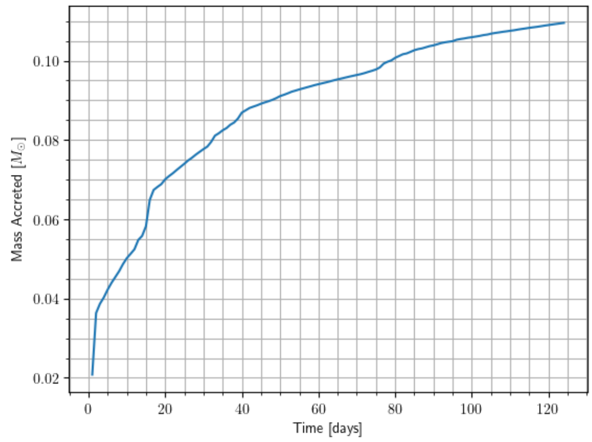


(a) Slice view

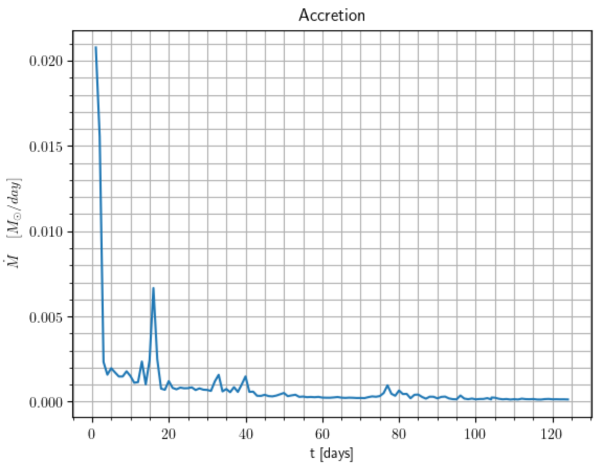


(b) Volume view

Figure 1. The initial density and velocity. In 2a we see the density along the x-y, x-z and y-z plane in logarithmic scale and the velocity. The angle of the thick disk $\alpha = 30°$. We use the star in the center as a boundary condition. In 2b we see the initial density voxel in linear scale and the velocity.



(a) Accretion



(b) Accretion rate

Figure 2. accretion rate

2 MODEL

using flash. setup physical details (disk mass radios and ext...) initial density (disk alpha angle),temperature,energy profile the simple analytical model from FKR Frank et al. (2002) and Abramowicz(1990?) Frank & Robertson (1988); Artymowicz et al. (1991) .... initial condition and boundary condition (adjust simulation) how to simulate the accreted matter. RadMC-3D to create spectrum (SED) and light curve RadMC-3D model chosen describe the process of creating light curve from spectrum XXX Mention the start in the center is not part of the simulation.

XXXX Fig for initial setup.

3 RESULTS

We run the simulation with these parameters ... on a cluster ... show graphs on matter and accretion .... accretion rate?

show graphs on spectrum and light curve (RadMC-3D results) with the following inc angle (0,30,60,90) + obs of bolometric light curve of V838 MON

discuss the first few days instability !

4 DISCUSSION

analysis of the relation of the result with the expected observation of V838 Mon discus the influence of the different parameter to the model what we expect and what we received

XXXXX compare velocities of lines from obs to velocities in the simulation. Figure Discuss the first few days numeric Rayleigh-Taylor instability and shock waves

5 CONCLUSIONS

what dose it say using this model in for such observation (thick disk model of accretion for red nova)

6 ACKNOWLEDGEMENTS

compute canada ariel university (scholar ship and ext...) Noam???

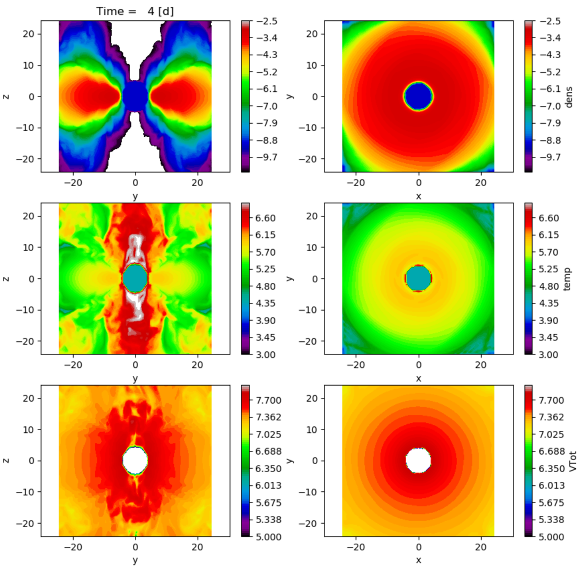


Figure 3. Slice view of the disk in time t

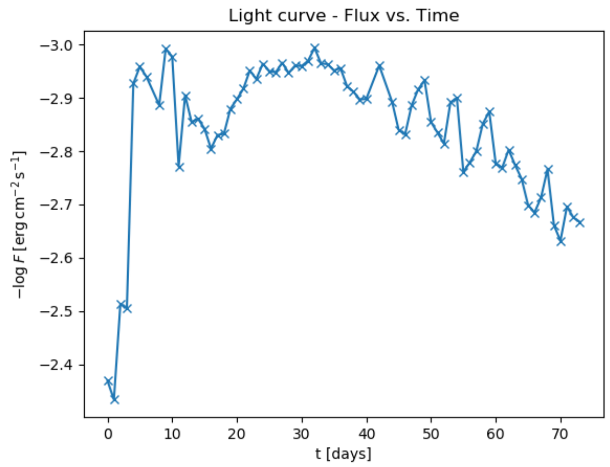


Figure 4. Light curve

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